THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXX. No. 746.] LONDON, AUGUST 28, 1877. [29TH YEAR.] Price 6d.

ESTABLISHED 1782.

GAS-WORKS

ERECTED BY

WILLIAM BLEWS & SONS,

BIRMINGHAM: 9 to 15, New Bartholomew Street.
WEST BROMWICH: Royal Eagle Tube-Works.
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MANUFACTURERS OF

IRON GAS TUBES AND FITTINGS, CHANDELIERS, & ALL ARTICLES REQUIRED FOR GAS OR GAS-WORKS.

References to upwards of 200 Gas-Works erected or supplied with Materials by
WILLIAM BLEWS & SONS.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT.

FOUR PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.

These Paints are now used in 150 Country Gas-Works, and by all the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*

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JOSEPH COWEN and CO.,
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J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

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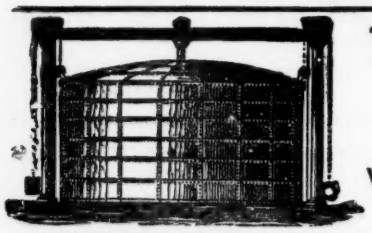
Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.



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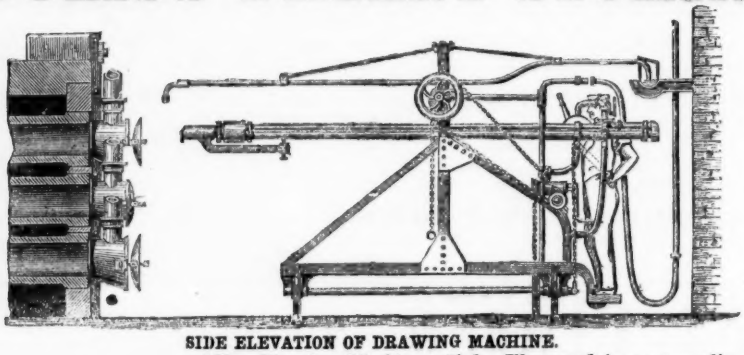
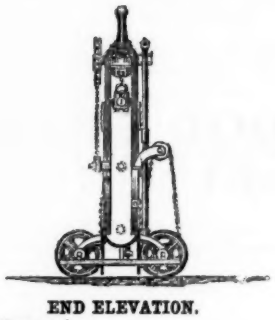


SIDE ELEVATION OF DRAWING MACHINE.



END ELEVATION.

(The Charging Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;
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SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

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AND PARLIAMENTARY APPLICATIONS CONDUCTED

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GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

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CONTRACTORS FOR THE

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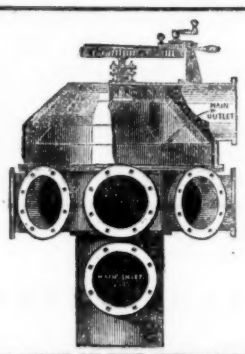
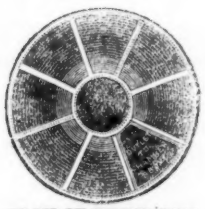
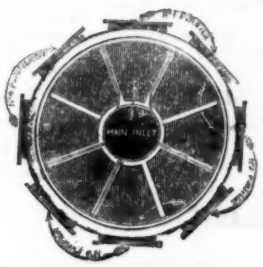


C. & W. WALKERS'

PATENT CENTRE-VALVES.





ELEVATION OF THE CENTRE-VALVE. PLAN OF THE VALVE. PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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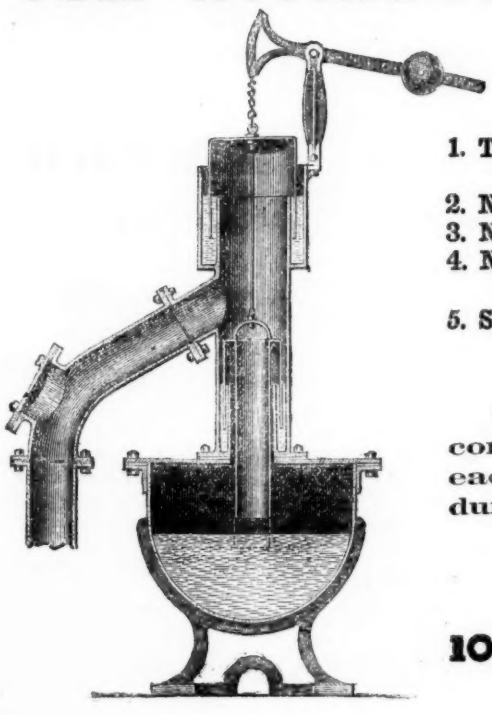
SELF-ACTING REMOVABLE DIP-PIPE,



PATENTED BY

CHANDLER & STEVENSON.

ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

These Dip-Pipes can now be supplied complete, except the flanched bend, for £4 each, which includes the charge for licence during the whole term of the patent.

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Who fix the Dip-Pipes, at a small Charge, when required.

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MANUFACTURERS OF

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Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

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INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

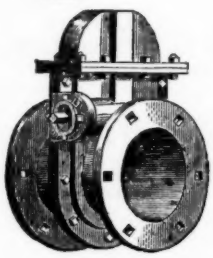
LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

B. DONKIN & CO.'S

IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

ALSO MAKERS OF

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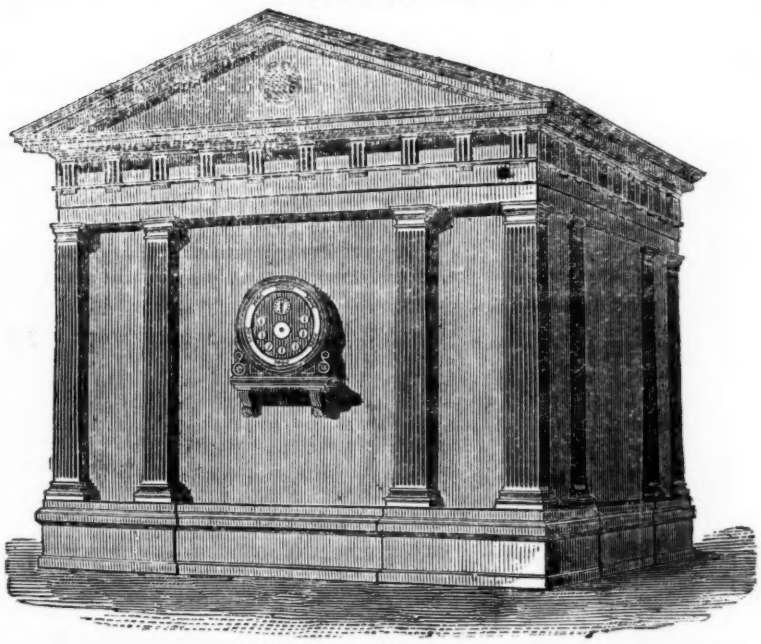

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Home and Foreign Orders promptly attended to.

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Orders almost invariably despatched on the day of receipt.

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INTERNATIONAL EXHIBITION, 1862.

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NEWCASTLE-ON-TYNE.

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Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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ESTABLISHED IN 1860.

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WOOD SIEVES

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GAS PURIFIERS & SCRUBBERS.

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RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 PER WEEKLY.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
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BY HER MAJESTY'S ROYAL LETTERS PATENT.
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FIRE CLAY & BRICK WORKS,
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Of all Dimensions for Gas-Works,
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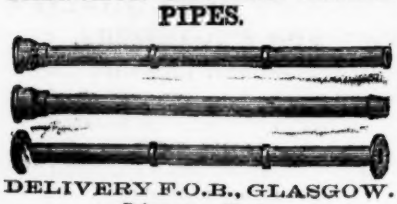

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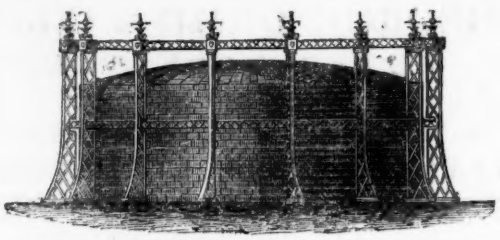

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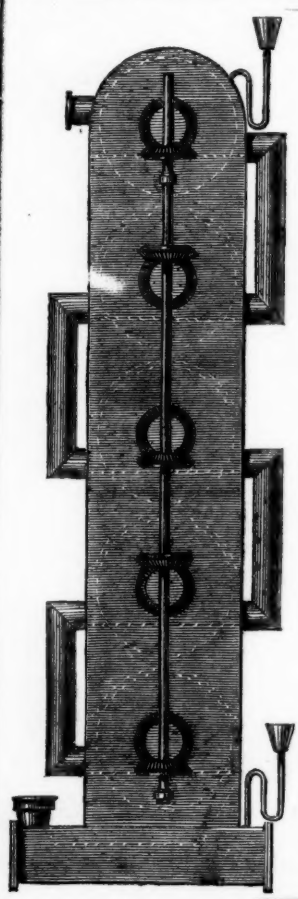

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April 27, 1877.

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The brushes cause no appreciable increase of pressure, and there is no repumping of liquor. Clear water run in at top, issues from the bottom fit to proceed to the sulphate-house.

It performs its work more efficiently than the tower scrubber I have, while only about half the height, and not one-fourth its weight or capacity.

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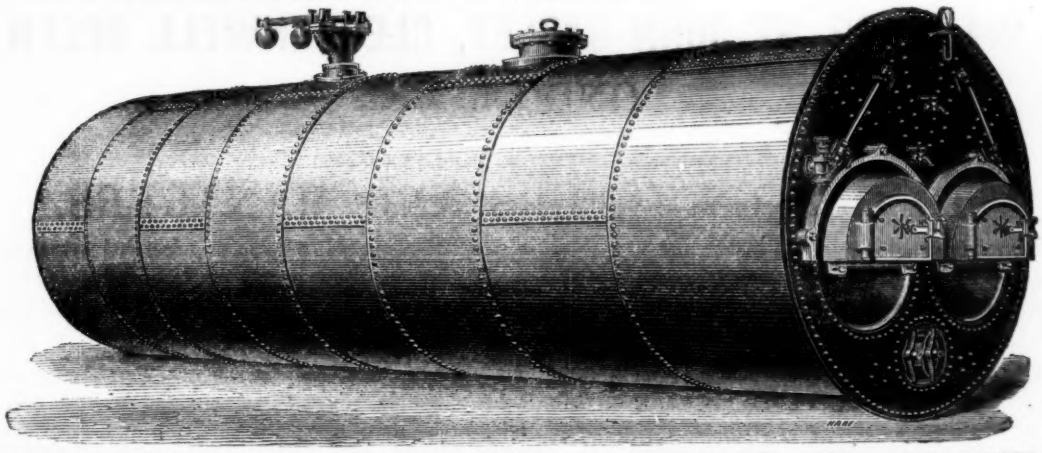

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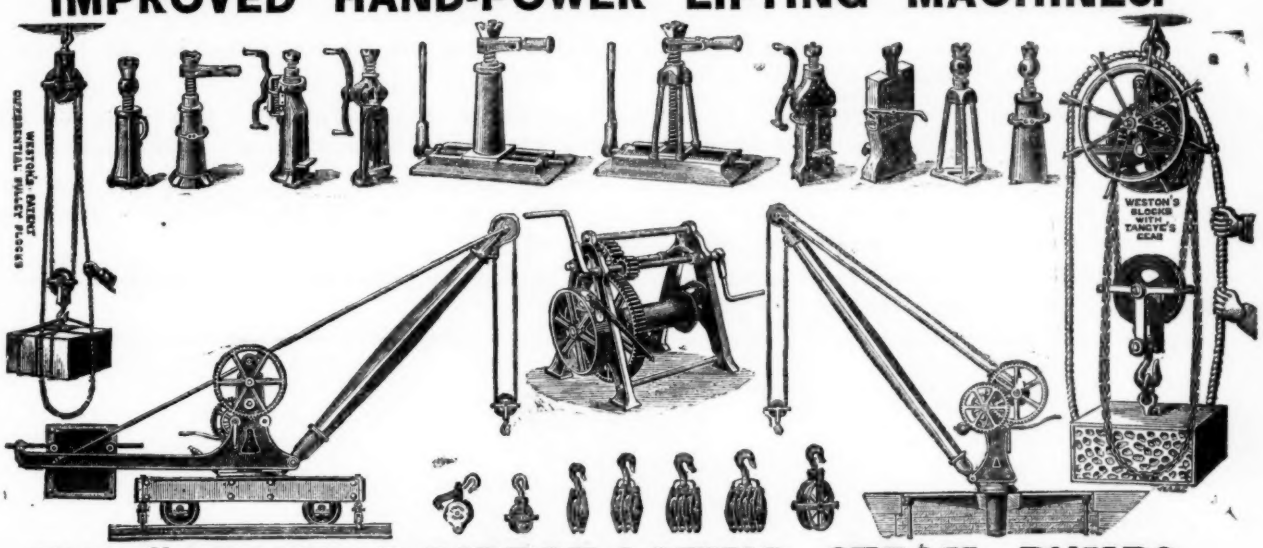

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5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
6	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65

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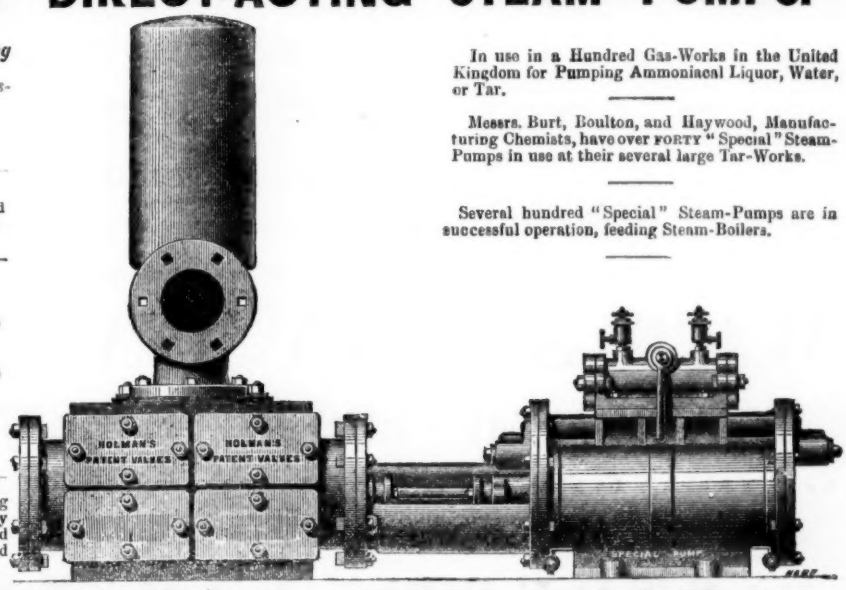

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It having come to our knowledge that a report is in circulation, spread by some unprincipled person or persons, nat the cases of our larger-sized Meters are made of Galvanized Iron, we think it only fair to ourselves, and just to our customers, to say, that we never have used, in making any of our Meters, a single pound of *Galvanized Iron*, or any other *cheap* and *inferior material*, and this can be easily seen by opening any of them.

The cases of our large-sized Meters, from 20 lights and upwards, are all made of the very *Best Best Patent Alloy*, which is nearly double the price, and will last more than double the time, of some other material that has been and still is very largely used for the same purpose. And our experience, acquired by an extensive use of it for upwards of 30 years, enables us to say with confidence that no other metal in use for the purpose is so little liable to corrosion from the action of the gas.

We have now in use a Meter made in 1848, and therefore 29 years old, the case of which is made of Patent Alloy; the Meter is still in perfect order, and shows no signs of decay.

The utmost care is exercised by us in selecting none but the very best materials for all parts of our Meters; much of it is made *expressly for us*, as it is not possible to obtain it in the open market of the same superior quality.

The great fall in the price of all materials used in making our Meters has enabled us to give an increased discount, thus giving our customers the benefit of the fall. This we were bound in fairness to do, as we raised the price of our Meters four years ago, when the price of all metals went up.

It will be our constant endeavour, by using none but the best materials, and employing the most skilful workmen, to maintain the high character our Meter has hitherto borne.

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METERS FOR MEASURING WATER.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

Mr. C. HASSALL, of Whitchurch, *writes, repeating a statement made by him in the* JOURNAL, *in* 1875, *that Clift's Brick Retorts were the invention of Mr. Parsons, of Birmingham. Without being in a position to contradict the statement on evidence, we cannot but remark that the late Mr. Clift always spoke of them, and allowed them to be spoken of, as his, and supplied calculations, quoted in Clegg, showing their economy as compared with others. He also read a paper before the Institution of Civil Engineers, describing his invention.*

S. J., London. *The report we published on the* 31*st ult., respecting the accident at Devonport, was taken from a newspaper, and acknowledged as such. No doubt disastrous consequences ensued from the fracture of the holder and the ignition of the gas, but there was nothing in the nature of an "explosion," as the report sufficiently indicates.*

G. H.—1. *If your meter is correct, and properly stamped as such, the company cannot refuse to supply you with gas through it (see sec.* 16, *Sales of Gas Act,* 1859, *and sec.* 13, *Gas-Works Clauses Act,* 1871). 2. *The company may require security, and, if not furnished, may refuse to supply gas.* 3. *Each separate tenant is liable.*

F. R.—*The relation of the secretary to the directors is as much social as legal. Legally, a secretary is not required to answer questions of individual directors outside the board-room; but we hope there are few cases in which such a want of cordiality exists between the officer and his employers as to lead to a refusal of a reply so made.*

H. E. C., Dunmow, *writes: "In tar, lime, and ashes we have the ingredients for a good pavement or garden path. Can any one of your readers give me his experience on this subject, and tell me the proportions in which the materials should be mixed?" In* 1870 *the late Mr. T. H. Methven read a paper on the subject at the British Association of Gas Managers, and an interesting discussion ensued thereon (see* JOURNAL, *vol. xix., pp.* 584–5). *In the following year Mr. George Anderson read a paper giving some "Further Experience of Tar Pavement" (see* JOURNAL, *vol. xx., p.* 553). *Our correspondent will find in these papers much valuable information on the point of his inquiries.*

INQUIRER.—*A company possessing a Provisional Order can legally make up all back dividends to* 10 *per cent. for the years, preceding the obtaining of the Order, in which there was a deficiency. There has not been a case decided in the Courts on this point.*

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 28, 1877.

Circular to Gas Companies.

A SCIENTIFICALLY accurate method of determining the amount of light which a given volume of coal gas could, should, or ought to afford when consumed, is, in the present state of our knowledge, unattainable. We suffer from defects on all sides—defective instruments, defective observers, and, worse than all as some will tell us, a very defective standard of comparison. Perhaps the defect that can be most easily remedied is the last named, and, as our readers have been more than once informed in our columns, Mr. A. Vernon Harcourt has exercised his wits in providing a substitute for the time-honoured candle. For ourselves, we must confess that we have a great respect for a genuine sperm candle. The cetacean provides us with a material which is undoubtedly of a definite and fixed chemical composition. The bee furnishes us with wax, also a combustible body of fixed composition, and in a mixture of these two in well-defined proportions, we have a compound which, if it could be burned under unvarying conditions, will afford a definite amount of light. But, unfortunately, the compound we have indicated must be burned by means of a wick, and thereby are introduced complications too numerous for mention. Then, again, temperature and certain atmospheric conditions greatly affect the quality of the flame. Still the sperm candle holds its place, and we consider deservedly, as the standard of comparison.

Nevertheless there is no reason why attempts should not be made to obtain a more perfect standard, and while we entirely differ from Mr. A. Vernon Harcourt, as to the value of his new standard, we commend his efforts, and acknowledge his originality. His paper, which we publish to-day, read at the recent meeting of the British Association, is an expansion of the ideas expressed in a lecture delivered to the Society of Arts, and already reported in our columns. The new standard is a mixture of the vapour of *pentane* (the fifth in the series of hydrocarbons of the paraffin class) with thrice its volume of atmospheric air. "Pentane" is certainly not a mythical body, but probably nobody ever saw it in a pure state. By repeated and carefully conducted fractional distillations on a small scale, no doubt a liquid can be obtained, which, when subjected to ultimate analysis, will exhibit a composition justifying the application of the term "pentane." But even within the limits of boiling points and vapour densities, which would justify this term, a number of other hydrocarbons may be present—Hexane, Heptane, perhaps Nonane might be present, in which the state of condensation of the carbon equivalent (to use the best expression which occurs to us), would seriously affect the character of the light. On a large scale, we may take it, "pentane" cannot be prepared. Thus, it would be necessary that every sample of this mixed vapour and air should be "standardized;" and how will this be done? Why, by comparison with the much abused sperm candle! If this be so, why not continue to use the candle, and save all the bother and apparatus which Mr. Harcourt would fain persuade us to take and adopt? What is there to be gained, if, after all, we come to a sperm candle as the standard of valuation?

We might advert to other proposed standards, particularly olefiant gas, which is always to be obtained pure, and the employment of which would allow of a perfectly different mode of expressing the value of a gas. Mr. Harcourt, we know, objects that olefiant gas is soluble in water. It is so to a small extent, but the water in the gasholder being saturated, no further absorption takes place. A definite mixture of olefiant gas and hydrogen, more nearly resembling the gas to be tested, would, perhaps, answer much better; but we have Berthelot's experiments before us, which go to show that the greater part of the illuminating power of a gas-flame is dependent on the vapour of liquid hydrocarbons — benzole mainly—which the gas carries.

Taking all circumstances into consideration, we adhere to the sperm candle as the standard of comparison. If Mr. Harcourt wishes to distinguish himself, let him devote his attention to the question of wicks, and arrangements by which gas and candles may be burned as nearly as possible under the same conditions.

The electric candle has frightened the Town Council of Hull, who have decided that application shall not be made to Parliament for powers to purchase the existing gas-works in their borough. We are not at all afraid of the electric candle, but we are certain that the Hull authorities have come to a wise conclusion. The ratepayers of Hull are spared the heavy expense of a parliamentary contest, which would certainly have been disastrous to them.

The Gas Committee of the Police Commissioners of Forfar seem to have blundered in their last year's estimates. They appear to have made a loss on the year's working, which obliges them to raise the price of gas 10d. per 1000 feet. It is not usual that Scottish authorities are so far out in their calculations. We have often been struck with the accuracy of the estimates made by them, and may express a hope that the "probable *plus*" expected in the transactions of the present year may be realized.

The fact is not, perhaps, widely known, but we are bound to inform the whole world of it, that the Town Council of Newbury have a Gas Committee. The borough is certainly not lively, but it has historical associations. We fancy we have seen grass growing in the roadway, but there are gas-pipes beneath, and of these, and all connected with them, the Corporation are anxious to get possession. It is the old story. The Corporation want the profits which may be made by supplying gas; in other words, they wish to lay a special tax on gas consumers. The borough is said to require a Lunatic Asylum, which will cost £10,000. Well, if the consumers choose to pay the interest on this sum, by all means let them do so, and thereby entitle themselves to admission to the Asylum.

We publish to-day a rather lengthy communication from Mr. G. Livesey, which we think is certain to attract attention and cause discussion. In the main we agree with the opinions expressed by our correspondent, who comes forward opportunely to support Mr. Bennett in recommending Gas Companies to consider the interests of the public as much as their own.

We also publish a paper taken from our valued French contemporary, *Le Journal des Usines à Gaz*, on the "Electric "Candle," which will have the effect of allaying all fears on the part of our most timid readers as to the danger of the competition with gas of this mode of illumination. The extravagant cost, and the more than extravagant waste of light produced at that cost, constitute an insuperable barrier to its use for more than mere curiosity.

The Lancaster Gas Company have had a very prosperous year. They are able to pay a full statutory dividend, with some arrears. In consequence of their success, and their favourable prospects, they have decided on reducing the price of gas 3d. per 1000 feet.

We have been courteously favoured with a copy of a report presented to the Town Council of the Corporation of Nottingham by their Gas Committee, together with a statement of the accounts relating to the gas undertaking. Although, as our readers know, we altogether object to the possession of gas undertakings by local authorities, we are bound to congratulate the ratepayers and gas consumers of Nottingham on the management of their undertaking. The profit made last year was £5781, and this sum is very wisely carried to a reserve and sinking fund. Good contracts have been made for coals for the current year, and the committee see their way to recommend a reduction of 2d. per 1000 feet in the price of gas. We shall publish the accounts *in extenso* next week, and shall then again refer to their favourable features.

Water and Sanitary Notes.

How the "Coming Race" will be supplied with water and the means of illumination we cannot even guess; but when that expected New Zealander, having finished his sketch of the ruins of St. Paul's, takes a pick-axe and shovel, and searches in the soil for records of the race which now inhabits this Metropolis, we cannot help thinking that, if matters remain as they are, he will be considerably astonished. The vast congeries of pipes which now lie under London streets could not but excite wonder; and to the present number it is to-day proposed to add two others through every street, with a service-pipe into every dwelling-house. The scheme, it must be confessed, is noteworthy, and does honour to its concoctors; but is the additional supply really required? We venture to think it is not. We consider the present water supply of London much more than adequate in quantity, and perfectly satisfactory as to quality. The Metropolitan Authorities are recommended to spend five and a half millions—which means, as Mr. Bramwell puts it, in a paper which we publish in another column, an annual outlay of nearly £200,000, to save £50,000 a year. The advantages promised from this expenditure are altogether problematical. General dyspepsia and other disagreeables would most likely result from a change to a hard water for drinking and culinary purposes; and as to the suggestion that large fires would be impossible if London were supplied with hydrants and water at high pressure, the idea is altogether visionary. Large and destructive fires are not unknown at Liverpool, Manchester, and Glasgow. Whenever a fire gets hold of a mill or theatre, at any one of the places named, it is burned to the ground as certainly as a London warehouse. A return has been moved for in the House of Commons, which will, we expect, completely prove our statement. Granting, however, that an additional fire service is necessary or advisable, who are in such a position to furnish it at the least cost as the Water Companies? We put drinking water aside, from a conviction that our present supply is all that can be desired.

From one point of view the Water Companies might be benefited by the proposed new system. They now supply water for extinguishing fires without fee or reward; but no alteration in their responsibilities in this respect could affect or alter the rates they are empowered to charge. It might offend their *amour-propre* to become simply purveyors of water for closets and lavatory purposes; but their profits would be increased, inasmuch as smaller charges would be incurred for pumping. We need not, however, speculate on the matter, for we believe that neither of the Metropolitan Authorities will give the scheme support. They will have the water supply in their hands in totality or not at all. The great question now agitated between the Authorities and the Water Companies is altogether passed over by Mr. Bramwell. His scheme would necessitate an additional 2½d. rate, leaving the Companies as they are, while the object of the Authorities is to obtain a reduction of the water-rates. The purchase of the companies would, of course, involve the imposition of a rather heavy rate, but not perhaps so heavy as that now levied by the Companies.

We might say that Mr. Bramwell cuts the ground from under his own feet, when he quotes the report of Sir Selwin-Ibbetson's Committee, to the effect that in this Metropolis so little is paid for the extinguishing of fires, while the losses are comparatively so small. Chicago pays more than twice as much as London, and is supplied by a constant service of water at high pressure, and yet more than a third of the best part of the city was consumed by fire. Fires at New York are proverbially destructive, although the supply of water is abundant, and the Fire Brigade service, mainly voluntary, costs about four times what the service in London costs. But we need not multiply illustrations. The fact stands prominently forward that London is adequately supplied with water for all purposes, and that a small addition to the strength of our Fire Brigade, estimated to cost £50,000 a year, will add largely to the protection of property. Why, then, to repeat an inquiry made before, should we expend five and a half millions on the scheme now proposed? — a scheme which, if carried out, would add nothing to the safety of London from destruction by fire, and would inevitably produce much inconvenience to the inhabitants. We freely acknowledge the ingenuity of the proposers; but, we say again, it will not do. It looks exceedingly well upon paper, and it seems to have captivated a great portion of the Metropolitan Press. But when it comes to be discussed by the Authorities who will be responsible for the outlay, we feel confident the scheme will be rejected.

The figures given by Mr. Bramwell are of much interest, and are, no doubt, based on carefully prepared estimates. Still, we have a fear that the five and a half millions would grow into something approaching ten millions before the whole works were completed. So, too, we think, the probable consumption of water has been under-estimated. The proposed new supply will be practically uncontrolled, and with extravagant use and leakage —which latter could not be entirely avoided with the best constructed apparatus—we conjecture that the estimated consumption of sixteen gallons per head per day would soon increase to thirty-two gallons or more.

And then comes the important question of the durability of a supply from the chalk. The Royal Commissioners of 1867 expressed an opinion that the chalk formation around and within a reasonable distance of London could not sustain a continued heavy draught, and we are inclined to agree with them. But the question is too important to be disposed of perfunctorily, and we must defer a full consideration of the matter.

That our present supply will soon have to be supplemented from the chalk we firmly believe, and for that reason we think that there is a great future for the Colne Valley Company, whose meeting we report to-day.

The Town Council of Liverpool are still agitated on the water question. They are convinced, as we are, that an extension of the well system will bring, at the best, but a temporary alleviation of the drought which is imminent, and they are still looking far afield for a source of supply. They have abandoned the Bleasdale scheme, as likely to prove too expensive. They appear, too, without sufficient consideration, to have given up the idea of bringing water from Windermere, and at the present moment the Water Committee have before them a proposal for an impounding scheme among the Welsh hills, which finds favour. We are, at present, ignorant of the localities suggested for the reservoirs.

The continued heavy rain in the Thames Valley leads us to expect that in the next report of the Registrar-General the water of some of the London Companies will be said to be "turbid." The finely divided clay and calcareous matter which is washed into the river by the rain subsides with great slowness, and is difficult to remove by filtration. There is, however, no harm in

it; and, moreover, the turbidity would not be recognized in an ordinary tumbler.

We understand that the agreement for the purchase of the Wakefield Water Company by the Corporation will take effect on the 1st proximo, when the consideration money—£48 for every £25 share, and £24 for each £12 10s. share, will be paid. We shall watch with some interest the proceedings of the Corporation in connexion with their newly acquired water undertaking.

The Town Council of Shrewsbury have purchased the undertaking of the Shrewsbury Water Company. The consideration agreed upon is £40,000, the Corporation assuming a mortgage debt of £6000.

The advocates of a lake water supply will hardly be gratified by the recent reports of Dr. E. J. Mills on the Loch Katrine water supplied to Glasgow. It is said to be organically more impure than Thames water.

Review.

TABLES FOR GAS MANAGERS.*

This work is a sort of French Newbigging, and to managers who understand French, and who have a faculty for easily converting the measures into the English equivalents, it will prove very useful. We may remark that the compiler of these tables enters into details not treated of by Mr. Newbigging, such, for example, as the differences of friction in cast and wrought iron pipes; the density of gas, and the relative loss at different densities. Some of the tables have been prepared by M. Arson, the eminent engineer to the Paris Gas Company, whose great mathematical skill is widely known among gas managers.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

THE TRUE INTERESTS OF GAS COMPANIES.

SIR,—I do not think that justice has been done to the original and able paper by Mr. Bennett on "Some of the Causes tending to Restrict the Use of Gas and Coke, and How their Consumption may be Increased," read at the meeting of gas managers at Bristol, and published by you on the 17th of July.

I thoroughly agree with the statements made by Mr. Bennett; it is the fact that gas companies, as a rule, take no steps whatever to increase their business. Shareholders and directors have the happy assurance that their full dividends are secured, and this being the case, the most powerful motive to improve and extend their business is wanting. The ordinary increase renders a satisfactory addition to the capital necessary from time to time, and the laudable desire to sell cheap gas is now practically annihilated by the knowledge that any company endeavouring to do their best for their consumers in this way will, on applying to Parliament for further powers, find themselves opposed by the local authorities, and their standard or maximum price cut down below that of neighbouring companies, simply and solely because they have served their customers better than others have done.

The same causes check the desire to make improvements in the manufacture. The wonderful inventive skill of the founders of the gas industry must either have been almost equivalent to inspiration, or some spell has bound their successors; for the improvements in our business are as nothing compared with those that have been made in most industries during the first 70 years of their existence. Take, for instance, the iron manufacture, and compare it with what it was at the beginning of this century, especially in the matter of the economy of fuel and the utilization of the waste gases and the waste heat (it is indebted to Neilson, of Glasgow, a gas man, for the introduction of the hot blast), and then show, if possible, anything at all approaching a similar advance in the making of gas. The enormous increase in the consumption of gas, due to its wonderful suitability for the purpose of illumination, should have been the reason for, and the means of, an enormous improvement in the appliances for making it, unless, indeed, the original inventors were favoured beyond all other inventors by the gift of infallibility.

After allowing for the larger scale of our operations, let me ask, What real advance has been made? In the retort-house we have substituted clay for iron retorts; but the great questions of economy of fuel and the utilization of the waste heat have received scarcely any attention, and our working and apparatus remain unchanged. The exhauster—introduced as a necessity on the adoption of clay retorts—is an undoubted improvement; but with the exception that the ammonia at first was left in the gas (not, indeed, that the means for its removal were not known, but because, when extracted, it could not be disposed of), the original condensing and purifying arrangements were similar and almost identical to those at present in use. The great improvement in purifying—the beautiful, cleanly, cheap, and efficient oxide process—whereby the greatest nuisance connected with gas-making was avoided, has been discarded, and we have been driven back to the use of lime, owing to the adoption of a fanciful method of testing, which has resulted in no benefit either to the gas maker or the gas consumer, but, in my opinion, in disadvantage to both. Managers have been so fully occupied with attempts to comply with these absurd refinements of testing, that they have had neither time nor opportunity to think of more important matters, whereby the supply of gas might have been improved and cheapened. "We are," in relation to purifying, as *Punch* made a cabby say, after Mr. Bruce's abortive attempt to deal with the cabs, "as we was—no better and no wus," as to results, but a great deal worse as to complication of apparatus, and working, and cost, while the public are no better off than they would have been had they been content with the original simple tests for purity; whilst as to illuminating power, a satisfactory test is wanting which, I am glad to say, Mr. Vernon Harcourt is doing his best to supply, with great promise of success. Gasholders remain much as they were at first, except as to size; and the means of distribution have of necessity experienced little change; but with the meter we have degenerated, for the later invention of the dry meter, very aptly described by Mr. Warner as a "tin box full of complicated gimcracks," is not to be compared with the beautiful and almost perfect invention of Clegg.

There have been, undoubtedly, many minor improvements, which I must ask your readers to believe I fully appreciate; but, notwithstanding what has been done, the remark is often made, and I have never heard it satisfactorily contradicted, that gas-making is in all essentials, scarcely changed since its original introduction.

Mr. Bennett, with commendable courage, tells gas companies "that to a dispassionate looker-on they never (except when they have had to contend with competition) have seemed to exhibit that energy towards increasing the consumption that might be expected from an enterprising tradesman, having unlimited capital at his command, and under similar circumstances," and after drawing attention to the possibility of extending the use of gas and coke, he enumerates various causes that tend to restrict the business, and shows how the desired (?) object may be attained. But here is the difficulty; the companies are satisfied with things as they are, and do not care to take the trouble that would be entailed by the adoption of the means indicated; they are, in fact, "protected," and therefore lack the energy that is a necessity in the case of "free trade." Competition, however, is altogether out of the question, and the "judiciously regulated monopoly" system, which has been in vogue for 20 years or more, has failed to give the healthy stimulus necessary to lead gas companies to adopt Mr. Bennett's valuable suggestions.

It might have been supposed that the desire to increase the investment of capital beyond the normal rate would have furnished a sufficiently powerful motive, and this, doubtless, has operated to some extent, for without it the system would have condemned us to absolute inactivity. To this our rulers have done their best or their worst to drive us, by the enforcement of the auction clauses, which, it will be remembered, were brought forward in the new Standing Order, entirely unaccompanied by any redeeming feature. I am in a position to state that this effect of the auction clauses was not foreseen by some of their most influential supporters in Parliament, to whom was shown the necessity and justice of adding the up and down sliding scale, which was at once adopted, and has now been formally approved by Parliament, and cheerfully accepted by gas companies, whose strong, nay, almost bitter opposition of two years ago has happily vanished altogether.

Gas companies will, as they come under the operation of the up and down sliding scale, have the very tangible inducement of pecuniary interest to lead them to improve the manufacture, and to extend the use, in order to cheapen the supply of gas. The restriction on their profits which checked enterprise is removed, and they have to choose whether they will be content with their ordinary dividends, with the possibility that if they rest on their oars they may, when hard times come, find those dividends reduced, or adopt such means as will result in increased dividends, and greater security for their investment. The security of the investment can be best attained by cheapening the supply of gas, for so long as illumination by gas is cheaper than by any other agent, gas is perfectly safe, and there need be no "scare" on account of electric candles, or petroleum, or anything else. Mr. Sugg once spoke of petroleum as the "enemy" to gas, and I believe he is right, for it is most extensively used by the working classes in London, whilst in America, where gas is dearer and petroleum cheaper than in England, it has come into very general use in places of business, seriously diminishing the use of gas.

The sliding scale, however, is a mere piece of machinery, which to be of any use must be set in motion, like the nursery story of the old woman whose "pig would not get over the stile," and the dog, stick, fire, water, ox, and butcher were all unavailing, until "the rope began to hang the butcher;" so, possibly, until the sliding scale begins to strangle the dividends, the good to be derived from it may be deferred. The shareholders of a company supplying gas in an important town a few miles south of London, where the sliding scale has been accepted, seeing this possibility, have at once applied the principle to the directors, by voting them an additional £100 a year for every increase of one per cent. in the dividend paid; they have, in fact, adopted the system so forcibly alluded to by Mr. Bennett, of "payment by results." But this system, to be of any real service, must be extended beyond the directors, to the manager, and as far as possible to those under him, who will have a great increase of life and spirit infused into their work when they feel that they will have a proportionate share of the prosperity to which they so largely contribute. I maintain, without fear of contradiction, that the system of paying fixed salaries never can give this necessary stimulus, and so long as that system continues, we shall look in vain for the great advances possible in our business. There may be difficulties in the way, but the chief difficulty is prejudice. Let this be overcome, and the others would vanish on an earnest effort being made to carry out the "payment-by-results" system in its entirety.

It is perfectly absurd to suppose that men generally will work in commercial matters with the same energy for others as they will for themselves. I have no desire to measure other men's corn with my own bushel, but, speaking only for myself, I confess that I do not see that either honesty or duty requires me to exert myself to the utmost for the pecuniary benefit of others. I am not, in fact, bound in any way to give more than an equivalent for what I receive. We know full well that in works of philanthropy and patriotism, or in the furtherance of Christianity, men are willing "to spend and be spent," even to the extent of life itself, in the service of others, and that the man is not worth much who, when duty of this kind calls, is found wanting. But in commercial life this high principle is totally inapplicable; it is rather "nothing for nothing," or, in other words, an equivalent for everything, that applies here.

* "Tables Techniques de l'Industrie du Gaz, &c." Par M. D. Maguier. Paris: Roret, Libraire-Editeur, Rue Hautefeuille, 12. 1877.

I maintain, therefore, that the only just and satisfactory system is that which gives to every man a proportionate share of the wealth he creates. I advocate this system because I believe it will give men an adequate motive for exceeding their ordinary routine sense of duty, and of exerting themselves to do their best in every way. I once heard it said by a director to a gas manager, "Let a man do his best, and make all the improvements he can, and then rely on the generosity of the directors for suitable remuneration;" to which the reply was given, that "such a recommendation was unfortunate, seeing that the directors he referred to never did anything for any one in their employ without being asked for it." I do not think those directors stand alone.

"Payment by results," in addition to the strong stimulus it would give a gas manager to exert himself to extend the business, and to invent improved means of working, would also lead him to adopt the inventions and improvements of others. This frequently entails a considerable amount of trouble, which, on the present system, is deterrent, and good things drop untried in consequence.

"Payment by results" would tend very materially to check, and probably in time to annihilate, the dishonest and unhealthy system of giving and receiving "commissions," for it would be the direct interest of the manager to purchase the best and cheapest articles of all kinds. It is hardly to be disputed that this obnoxious practice could not have grown to anything like the extent it appears to have attained had "payment by results" been the rule instead of payment by fixed salaries. It is, in my opinion, with which most men with whom I have conversed agree, entirely out of the power of directors, by any supervision they may exercise, either to find out or to prevent "commissions" if the manager is open to accept them.

There are great possibilities in the direction of cheapening the production of gas, and of increasing its use, but no man can be expected to exert his inventive faculties, or to go beyond his every-day sense of duty, to extend the business of others, unless he has the stimulus of sharing proportionately, to some extent, in the result of his own labour. There can be nothing dishonest in this; it is an essential part of human nature; and by this means companies especially would do well to develop to the utmost the capabilities of those who serve them.

London, Aug. 25, 1877. GEORGE LIVESEY.

THE CONSTRUCTION OF CONCRETE GASHOLDER-TANKS.

SIR,—Having occasion to construct a gasholder-tank, 72 feet diameter and 18 feet deep, in a locality where bricks are not available, but the materials for concrete easily procurable, I propose to adopt a method of construction which is so far unusual, that I should be pleased to obtain the advantage of some discussion thereon through your JOURNAL, possibly from some engineers who may have had experience on the points I wish to elucidate.

I propose to construct the tank annular, in the following manner:—Excavate a ring, in the usual way, 6 feet diameter to the full depth, and close board it if necessary; then lay a foundation of 12 inches of concrete, and in it place a ring of No. 11 B.W.G. plate, 3 feet wide for the bottom of tank, having inner and outer curbs of 2½ in. by 2½ in. by $\frac{5}{16}$ in. angle iron, bottom joints to be also made with angle iron. Then construct the shell of the tank with sheets of No. 15 B.W.G., in tiers of, say, 4 feet high, and as each tier is rivetted, fill in behind with concrete, say, 18 inches thick. Tiers to be put together with angle-iron curbs, so that the figure of the interior will be kept true by double angle irons at every 4 feet of height. The inner ring to be 12 feet high from the bottom, and the dome covered with 6 inches of concrete plastered. Inlet and outlet pipes to be in tunnels under the tank and pierce dome. Columns to stand on concrete piers.

The concrete, of course, would constitute the element of stability in such a tank, while the sheeting would act as a permanent frame for it, instead of using the wooden frames, which are often very inconvenient and troublesome. The iron would be well oiled and painted, and rivets at 2 inches pitch would suffice. Guides would, of course, be provided for the rollers of the gasholder, and precautions would be taken to prevent surface water from percolating between the sheeting and the concrete. The chief points to be observed would be to make the concrete homogeneous, and prevent the iron from corroding. This being attended to, and assumed as being accomplished by the usual means, would this method of construction be advisable under the circumstances?

The cost may be taken as follows:—

Excavations, 1500 yards at 2s. 6d. . . .	£187 10 0
Concrete (blue lias) 480 yards at 6s. . .	144 0 0
Sheeting, 15 tons at £25	375 0 0
Total	£706 10 0

omitting general and minor expenses chargeable to any description of tank. W. H. Y. WEBBER, Engineer.

4, *St. Thomas's Gardens, Haverstock Hill, N.W.*

WARRINGTON GAS-WORKS PURCHASE.—At the monthly meeting of the Town Council of Warrington, on the 7th inst., the town-clerk submitted a list of shareholders in the gas company, electing to take bonds at 24 years purchase, amounting to £18,645 12s. It was resolved that the list be handed to the Finance Committee for payment.

GLASGOW WATER SUPPLY.—The report for August on the quality of Loch Katrine water, prepared by Professor E. J. Mills, D.Sc., F.R.S., of Anderson's College, has been issued. The results are returned in parts per 100,000:—

	Aug. 13.
Total solid impurity	3·40
Organic carbon	0·168
Organic nitrogen	0·000
Ammonia	0·000
Nitric nitrogen	0·004
Total combined nitrogen	0·004
Chlorine	0·73
Hardness	0·66

The water was very pale brown in colour, and contained muddy particles, with a slight amount of fibrous matter. Its most serious impurity, the organic carbon, exceeded last month that of the whole of the metropolitan waters, and is this month about one-third higher than in August, 1876.

Parliamentary Intelligence.

HOUSE OF LORDS COMMITTEE.

FRIDAY, JULY 13.

(*Before Viscount* SIDMOUTH, *Chairman; Lord* BLACHFORD, *Lord* DIGBY, *and Lord* LECONFIELD.)

WATERFORD GAS BILL.

(*Concluded from page* 297.)

Mr. RICHARDS said he did not intend to call any more evidence for the promoters of the Bill.

Mr. SOMERSET said he proposed to call his witnesses before addressing the committee.

Mr. *Howard*, town-clerk of Waterford, was called by Mr. SOMERSET, and produced the minutes referred to by Mr. Allen on the previous day.

In cross-examination by Mr. RICHARDS, witness said there had been no public meeting of the ratepayers, although they had petitioned against the Bill. On April 3 a sum of £250 was voted by the corporation for the purpose of opposing the Bill of the gas company, and on June 22 a further sum of £300 for the opposition in the House of Lords.

In reply to Mr. SOMERSET, witness said that everything had been done which was required by Act of Parliament.

Mr. *Joseph Fisher*, examined by Mr. SOMERSET.

I am a member of the Corporation of Waterford, and have taken much interest in this matter for many years. My recollection is that in the Bill of 1858 there was a clause giving power to the company to let the works, but that the clause was struck out, whether by Lord Redesdale or not I cannot say. My impression is that at that time Messrs. Anderson and Jones were treated really as the company, and that it was they who promoted the Bill. I never heard until yesterday that Mr. Anderson made £2000 by the sale of the works—that came upon me by surprise—but I think it was proved in the House of Commons that Mr. Anderson had 200 shares in the company, which would represent £2000. In the preamble of the Bill of 1858 there is an expression which I suppose was not struck out when the clause was struck out:—"And shall also let their undertaking as hereinafter mentioned." No doubt those words ought to have been struck out, but they remained in by oversight.

Mr. SOMERSET: But the lease or agreement, or whatever it was, as soon as the Bill passed, was entered into with Messrs. Anderson and Jones; and, as their lordships know, other agreements have been come to, the present one dating from 1873, and lasting for 14 years?

Witness: Yes.

Let me call your attention to this agreement—what is your view of it as a member of the corporation and as a consumer of gas?—My view of it is that the directors of the gas company are trustees for the gas consumers of Waterford, and that the Act of 1847 gives the whole of the annual revenue over 10 per cent. to them; and that the company stand towards the consumers in the position of trustees, bound to carry out their works to the best advantage, and to apply the balance to reduce the price of gas. We therefore look upon the arrangement that Messrs. Anderson and Jones have made by themselves as shareholders, and through their friends coercing the directors, as altogether *ultra vires*, and very prejudicial to the interests of the consumers of gas in Waterford.

Whether it be a mere technical question, as to whether it is a lease or an agreement, that is not what you object to; but you say that they in fact get a much larger profit than they have a right to do under the Act of 1847—that is to say, more than 10 per cent.?—Most decidedly; and Parliament this year, in a similar case, has inserted a clause in the Commons, and it has gone through the House of Lords unopposed, that in any case of an agreement like this, the contractors profits are to be included in the 10 per cent.—that is to say, the consumers of gas are not to be paying two profits, one to the contractors of, probably, 10 to 15 per cent., and another to the shareholders. I refer to the Epsom and Ewell Gas Bill, and I consider such a clause as that is absolutely necessary to protect the consumers of gas at Waterford, because they have been fleeced both by the company and the contractors.

When you use the word "fleeced," do you represent that it has been endeavoured, and vigorously endeavoured, for many years past, to find out what the real profits were?—Yes; the accounts that have been deposited do not disclose the profits. I mean to say that the accounts which have been presented show that the directors themselves, upon the face of the accounts, earn 12 per cent., but they only divided 8 per cent., and the remaining 4 per cent., instead of being applied to reduce the price of gas, is applied to improvements; and they now ask your lordships to allow them to charge interest on money of our own, which was taken from us in perpetuity.

Mr. SOMERSET having put a question to the witness with regard to the profits made by the contractors,

Mr. RICHARDS objected, and after some discussion,

The CHAIRMAN ruled that questions could not be asked as to Mr. Anderson's profits, and inquired whether the object of the learned counsel was to get inferentially what Mr. Anderson's profits were.

Mr. SOMERSET said that was so, and after some further remarks by Mr. RICHARDS,

The CHAIRMAN said there was no objection to Mr. Somerset putting such questions as would enable the committee to calculate what Mr. Anderson's expenses were.

Witness: In 1874, which was the year of the coal famine, I make out that the contractors profits were not so much as the £700 charged here—they were about £500. I can give the details if it is wished.

The CHAIRMAN: It is the details we want.

Witness: Then I think I can give you the figures, though I have not a copy of them. There is a total of £6024 3s. 3d., and there is an item of "Ground-rent and taxes, £91 2s.;" but rent and taxes of that kind ought not to be put into this account as respecting the contractors.

Mr. MICHAEL: This is not the contractors account.

Witness: There is "Ground-rent and taxes, £91 2s.," in the directors accounts charged, but it ought not to be taken into account in both of those statements. Then "Sundries and stationery, &c., £152 9s. 11d.," which is a charge upon the directors also. Then there is £100 4s. 10d. for directors salaries also charged; but none of those items are contractors charges. Those items amount to £343 18s. 9d., which, deducted from the £6024 3s. 3d., leaves £5680 4s. 6d. as the contractors amount. Then there is "Manager's salary, £400;" "Interest, £300;" making £700; which reduces it to £4980 4s. 6d.; and as I understand the custom is to charge the following year's price of gas with the coals of the former year, I take from the account of June, 1875, £5488 0s. 4d. to set against that £4980 4s. 6d., which leaves the balance of the contractors profits at £507 15s. 10d., and that is the way I would make the account stand. I may also remark that the promoters yesterday put in an account of the consumption of gas for the year 1876, in which they represented the total amount of gas consumed to be above half a million cubic feet more than Mr. Jones put into his account, and the result is that all these calculations as to the cost of gas are wrong, because, according to that account, if they produced 28,373,800 cubic feet, they only, in the former account, calculated upon 27,851,000 feet.

It will be seen that when the expenses are divided upon that all the 52d. are put out, and every one of the items of calculation are wrong—the basis of the accounts is wrong, and the price that is put as the cost of gas is wrong; it must be so. It will also be seen in that account that coals are put down there as costing 30s. 9d. per ton. Mr. Anderson proved yesterday it was 20s.; but the chairman of the company, in the House of Commons, proved that it was only 19s., and I think he was more likely to be correct. But, to take Mr. Anderson's own figures, there is a saving of 10s. 6d. per ton. Mr. Anderson stated that there were 3600 tons used, so that I make the actual price of coals £1890 less than was paid in the year we have been dealing with. I have very imperfect materials to go upon, but if your lordships will follow me you will see that there has been an absolute saving to the contractors for coal of about £1890; there has been a reduction of 3d. per 1000 feet in the price of gas, which, subject to discount, brings it down to 5s. 9d., and that brings the £1890 to £1515; but there is not a single penny of that appearing in the company's accounts. They say that Messrs. Anderson and Jones, or Mr. Anderson, made that £1515 in the last year, in addition to the £507 he made in the coal famine year.

That £1515 is, upon £16,000, 9 per cent.?—It is.

Therefore you make it out that the company made 11 per cent. last year, and that in addition £2000 was made by the contractor, which is something like 13 per cent. upon £16,000?—Yes.

[Witness was examined by counsel and committee at some length on this point, but his answers were merely reiterations of the before-mentioned figures.]

Mr. SOMERSET: The maximum price of gas, under the Act of 1858, being 6s., with a certain discount, can you say what will be the effect under this Bill, if it should pass under its present form?

Witness: The Bill, as it is now, fixes the standard or initial price at what was the maximum price, but I think that, if the House of Commons had been distinctly informed that the company were only charging 5s. 9d., and making over that, they would never have given 6s. as the initial price.

Is this statement in your petition true:—"Your petitioners say that the standard price prescribed by the Bill will be for consumers under 30,000 cubic feet, 5s. 1d., whereas they now pay 5s. 2d.; for those consuming 30,000 to 40,000 it will be 5s. 1d., whereas they now pay 4s. 7d.; and for the public lamps, paid for by your petitioners, it will be 5s. 1d., whereas they now pay 4s. 3d."?—That is supposing that they do not exceed the standard price, but, under the Bill, as now drawn, the maximum price may be increased very considerably.

Examination continued: At the arbitration in 1862 the company asked 5s. per 1000, and arbitrators only gave them 4s. 6d.; and we hold that if the standard price passes we shall have to pay 5s. instead of 4s. 6d. At the arbitration in 1874, the corporation offered £3 10s. per lamp, but they afterwards increased it—3s. 10½d. per 1000 feet was all they gave for gas—and if the arbitrators had only given 10s. 6d. per lamp for lighting, &c., it would have made it £4 0s. 6d. against us; but the arbitrators—Mr. Spice was one, being bought over at great expense by the gas company—increased the amount to 18s. 6d. The most curious theory was that we considered the company were bound to deliver the light to us in the lantern, but they said they were only bound to deliver it in a hole in the street at the bottom of the lamp-post, and that we were to pay for the lamp-post and the lantern, and keeping them in repair, and that 18s. 6d. was charged for what we thought the company ought to supply.

Mr. SOMERSET: In the preamble there is a recital about certain land, and in the schedule it states something with reference to 2½ acres?

Witness: The copy of the Bill I have here is the one originally lodged, and there is no schedule to it whatever, and no paragraph in the preamble about this land. In our petition to the Lords we state the company are erecting works outside their land, and we were under the impression, whether rightly or wrongly, that the preamble was amended and a schedule added without complying with the Orders of Parliament, in order to try and obtain sanction for having the whole of the land which they had no authority to take under their original Act, and which they could not have obtained from Parliament, not having given notice last November.

In fact, the object of this schedule and the recital of the preamble is to legalize the use of certain land which they have occupied without legal power?—So I read it.

Mr. RICHARDS: Would it make my learned friends happier if we struck out the two and a half acres? We are not taking any fresh land. I say in the most perfect good faith that there is not the slightest intention of using a yard of it.

In reply to the committee, Mr. RICHARDS said there was nothing in the Act beyond the recital of the fact that the gas company had erected gas-works on certain land.

The COMMITTEE: Does that convey any land to them?

Mr. SOMERSET: I contend not.

Mr. RICHARDS (after some discussion) said the words in the schedule were put in by Lord Redesdale, and suggested that the agent should be sent for to prove the fact; but

Mr. SOMERSET expressed himself satisfied.

Examination resumed: The accounts are audited by their own auditor. I heard Mr. Richards say he should object to any auditors appointed by the corporation, but it is done elsewhere.

Mr. SOMERSET: In the notice for this Bill dated Nov. 13, 1876, I see, "To enable the said aldermen and burgesses from time to time to appoint an auditor of the company's accounts"—that is their own notice, and that is what he says he will resist to the last?

Witness: Just so.

Cross-examined by Mr. RICHARDS: The corporation manage the water-works pretty well, considering all things. The conduct and management of the water have very much improved. It was very objectionable, but since I became a member of the corporation the thing has been considerably changed.

Mr. RICHARDS: No doubt Paradise itself would be improved by your presence?

Witness: We have certainly doubled the receipts for water.

Is that since some of those thrilling articles appeared in the paper of which you are proprietor (the *Waterford Daily Mail*)? You wrote some strong articles, did you not?—I find one's presence on the board is far better than newspaper articles, but I did write some very condemnatory articles.

That, I suppose, brought them to their senses?—I do not think so, I imagine it was the citizens who altered the constitution of the corporation very much.

You were not satisfied with the management of the water-works till you interfered?—No; I was not.

You were well pleased on the whole, were you not, with the decision of the House of Commons on this Bill?—When the announcement was made with regard to the preamble, I thought it was very fair; but I was astonished that the House of Commons had increased the price of gas from 5s. 9d. to 6s. 1d. without notice and in the absence of the opponents; and I believe the committee of that House altogether exceeded their powers under their own Standing Orders. If it had not been for the Standing Order of the House of Lords, that no Bill would be received by Lord Redesdale after the 23rd of June, we should have had the third reading postponed, and Mr. Butt had actually given notice of that.

You talked of the price of gas being increased to 6s., and it is 6s. subject to a discount of 15 per cent.; is not that on the whole a decrease to a large mass of the consumers?—Decidedly not. It lessens the price of gas 1d. per 1000 on one class of consumers, and increases it very largely on the others.

Who are the larger set of consumers?—The poorer class and the lower section of the middle class. Those that consume under 20,000 feet a quarter.

Are you one of those who will not benefit?—Decidedly; it will increase the price of gas to me very considerably.

You heard what Mr. Madden said about the relative number of consumers—are not those who will benefit by a reduction in the price infinitely more numerous than those who will suffer from the slight increase?—Numerically it is so, but I do not think it will make a difference of 1s. a year to those 876 persons whose consumption is under 20,000 feet.

How many people are there who might suffer inconvenience from the slight rise?—There are 2000 people who will have to pay an increased price for the public lights, and it will be more upon them than the shilling to the others, but I cannot give the number of private consumers who will be affected. Mr. Madden has given the figures, and I do not dispute them.

When you talk about persons being interested as ratepayers, is there any lighting rate in Waterford?—Not at present, but we shall have to impose a borough rate to pay the additional price put upon us.

Cross-examination continued: Our corporate property has increased in value within the last four years, and there will be a slight increase next year. We have the matter at present before us, that we shall have to raise a borough rate for the interest of money borrowed for the water-works, and if this Bill is carried, we shall have to impose an additional tax on the city.

Mr. MICHAEL: Under the Act of 1871, which is about to be incorporated with this Bill, there is a power of having an arbitration on the subject public lights if you are unfairly charged?

Witness: We have that power now; but it is to be changed from under the Lands Clauses Act to the Companies Clauses Act, and I do not think that would be so beneficial to us; because under the former Act the gas company are liable for the whole expenses unless they get the amount they demand, and that might be altered by the other Act. A late arbitration case cost the gas company £200, and they had not the power of getting one penny from us.

Under the award of Messrs. Spice and Corregan, I see at the end of it they say, "And we do further award that the corporation and the company shall respectively abide their own costs, dividing moietively"?—That is entirely contrary to the clause in the Act of Parliament under which they acted, which defined their powers, and the arbitrators had no authority to make such a finding. We did not attempt to set aside the award, because in one year it only made a difference of £80 to us; but we have not paid our costs.

I understand you take exception to floating capital. Can a business be conducted without floating capital?—The Act of Parliament gives the company the capital, and they cannot possibly charge, in the price of gas, interest upon any capital beyond that.

The CHAIRMAN: The contention, I suppose, practically is, that the interest upon that capital should not be charged as part of the contractors expenses, because the company ought to pay them out of the parliamentary capital?

Mr. SOMERSET said that was the contention he should put before their lordships.

Mr. RICHARDS: Can the business of manufacturing gas be carried on without floating capital?—Yes; if the company get the capital that Parliament is going to give them, they will have their *bonâ fide* capital to use, instead of its being illegally used as it is at present.

You also object to the entries for stationery, office expenses, and so on. By the agreement with Mr. Anderson he has to collect all rates due, and, therefore, do not the office expenses necessarily become an element in his outgoings?—If these are expenses in Waterford; but I thought all the expenses in Waterford were included in the item of £827, and that the £152 was a directors expense.

Cross-examination continued: The company have power, under the Gas-Works Clauses Act 1847, to create a reserve-fund, and they have done so to the extent of £1047 11s. 6d., out of £1600 which they might have. They have a balance of £736 besides on the revenue account, and if those two are added together it would make more than the authorized reserve-fund. They could carry the whole of that £736 to the reserve-fund.

Mr. RICHARDS: Does it not strike you that out of that sum has to come the dividend for the next half year?

Witness: Decidedly not.

They are at liberty, are they not, under the Act of 1847, to make up their back dividends to the full 10 per cent.?—They are at liberty to make good back dividends, provided they do not form a reserve-fund; but the moment they form a reserve-fund that bars them from paying any back dividends—it is distinctly so in the Act.

Re-examined by Mr. SOMERSET: We want to erect markets, and there are several other improvements we wish to make, but if we are to be taxed for gas we cannot carry out these improvements.

Mr. *Lawrence A. Ryan*, examined by Mr. FITZGERALD.

I am a member of the Corporation of Waterford, and also one of the largest ratepayers. There is a very strong opinion both inside and outside the corporation against this Bill. The general opiniou is that the working of this agreement is prejudicial to the consumers of gas; and looking at it from a common-sense point of view, it does appear to be entirely contrary to the spirit and intention of the Act. I think it would be an advantage to get rid of a third party coming between the company and ourselves. There is not a city or town in Ireland more favourably circumstanced for supplying gas cheaper than Waterford. In the first place, the rates of insurance are considerably lower than the rates of Limerick and other places, and the freights are 25 per cent. less from Newcastle to Waterford than they are to Limerick and other places. I was not aware that the municipal taxes on the Limerick Gas-Works amount to £300 a year, although I knew the amount was large. There is no such charge on the Waterford Gas-Works. At Limerick there are two gas-works, and a much larger extent of mains, and consequently a greater extent of leakage—nearly three times as large. At Limerick, also, the works are three times as large as those at Waterford. In my judgment, there is no reason, in the present state of the coal market, for raising the price of gas in Waterford upon any class of consumers; but there are several reasons for reducing it. In the year ending June, 1876, the company charged the consumers 4s. 8½d., and paid Mr. Anderson 3s. 4d. Now they are only paying him 3s. 2d., so that the price ought to be only 4s. 6d. or 4s. 6½d. In my opinion, the works could be managed very profitably for the consumers if they were transferred to the corporation. I wish to refer to one thing in Mr. Anderson's evidence of yesterday, with regard to the cost of coal. I am perfectly well acquainted with the carriage of coal at Waterford, and he could not possibly pay 2s. 3d. for the cost from the vessel to his works; it could not be at the outside more than 1s. 3d., and if the company have paid Mr. Anderson on that basis, they have paid him too much. Mr. Anderson puts down 4d. to 5d. for discharging from the vessel into the barges; there is no such charge. The

coals are put into the barges from the vessels without charge. The only charge Mr. Anderson has to pay is that to the bargemen, for conveying the coals from the vessel to the works, and that cost would be about 1s. per ton, and then there is the cost of 3d. or 4d. a ton for putting it from the barge into the works. There are no canal dues or any other dues. In the *Gazette* notice published by the company, they mentioned that they proposed to take powers to transfer the works to the corporation, and Mr. Richards, in his opening speech, stated that was one of the clauses proposed to be inserted in the Bill, but when the corporation left the room, on consideration of clauses, by some manipulation that clause never appeared in the Bill at all. With regard to the remarks made by Mr. Allen yesterday, I may state that it was I who moved the resolution in the council as to these proceedings, and I never asked a single individual, either inside or outside the council, to come to my support. The feeling was so strong that there was no necessity, and there were only two opposed to me out of the whole body.

Mr. *George Wilson Stevenson*, examined by Mr. SOMERSET.

I have considered the present Bill and the petition of the corporation, and also the general question which is before the committee. My attention has also been called to the statement prepared by Mr. Jones for the arbitration of 1875, based upon 1874, and I have made a calculation formed partly upon that, but it does not apply altogether. The quantity of gas is not the same, the quantity of coal is not the same, nor the price of coal the same—therefore, in respect of those three items, the calculation of 1874 does not apply now, but I have taken it, as far as it is on all fours with the present case, as the basis of the calculation, which I think I had better put at once into the hands of the committee. The coals used in 1874 were 3547 tons for the sale of 28,374,000 feet—that is about 8000 feet to the ton. In the same ratio, 3805 tons was the quantity of coals used in 1876. The residuals (coke and tar) in 1874 realized in money 40 per cent. of the cost of coal. The cost per 1000 feet sold in 1874 for manufacturing charges, wear and tear, management, distribution, rates, taxes, law and other expenses, excluding the 6 per cent. upon the £5000, which is no element at all in the cost of gas, being working capital, was 21·3d. per 1000 feet—all the charges, except coal, came to 21·3d. per 1000 feet. I will now apply that to the year 1876. The proper standard of price for gas was arrived at this way:—The amount of working expenses per 1000 feet upon 3805 tons of coal at 20s. 3d., the cost given by Mr. Anderson yesterday—although it is within my knowledge that coals can be carried to Waterford at the present time at much less than 20s. 3d.—works out to £3853. Then I have deducted 40 per cent. for residuals (coke and tar) £1541, leaving the net cost of the raw material £2312, or about 1s. 6d., per 1000 feet. Then all the other costs of purification, labour, wear and tear, management, distribution, rates, taxes, and so on, except coal, is taken at the same rate per 1000 feet as in 1874—their own statement, 1s. 9·3d. making a total cost per 1000 feet of 3s. 3¼d. Then to ascertain what the standard price should be in order to secure the company in the enjoyment of their maximum dividend at the present time, I add 10 per cent. upon the £16,000, 5 per cent. upon £4000, and 5 per cent. upon £2000, the various classes of capital in the Bill, amounting together to £1900; and that works out at 1s. 3d. per 1000 feet of gas sold, making as a proper standard price 4s. 6¼d. instead of 6s. in the Bill, with a compulsory discount of 15 per cent., which brings it down to 5s. 1d¼. In my opinion that is 6¾d. more than is required to pay all expenses and the maximum dividend, upon their own figures. Then Mr. Anderson gave the sale of gas also at 30,443,000 cubic feet, and the price of 6¾d. would give him an additional profit of £856 a year, which is equal to another 4 per cent. all round upon the share capital.

Mr. SOMERSET: Then it being clear, upon their own figures, that their outgoings and maximum dividends can be made by 4s. 6¼d., what is the result?

Witness: One of two things must follow—if the price in the Bill remains as it now stands—either the full price for the gas will be charged, and the 6¾d., or £800 odd, will go into the pockets of the directors, or it will be in the option of the company to fix a price lower than 5s. 1¼d., but exceeding 4s. 6¼d., which will give them the largest amount of profit they can get, together with the largest amount of dividend. I cannot say exactly what it would be, because I have not calculated it; but obviously if they were to charge 5s. 1¼d., which is the maximum price in the Bill, they could not put any more money into their pockets, because they are charging the maximum price, and they can only increase their dividend by charging a less price than their maximum. There is a point between 5s. 1¼d. and 4s. 6¼d. at which they could make a profit, which they could divide among themselves in addition to the 10 per cent. dividend It would probably be something half way between the two, so that they would immediately put about 2 per cent. additional to the 10 per cent. into their pockets. That is perfectly straightforward and simple, and it is what they will do to a dead certainty, unless the contractors, under their contract, take the whole profits and put them into their pockets. It is what the South Metropolitan Gas Company are doing at the present moment in London. The South Metropolitan Gas Company in London take a 3s. 6d. standard price with a sliding scale of dividends. They are charging 3s. 2d. per 1000 cubic feet at the present time, and earning enough money to put an additional 1 per cent. into their pockets. Their dividend is 10 per cent., but the 4d. which they reduced below 3s. 6d. gives them four times a quarter per cent. In this Bill, as it is before their lordships, the promoters are entitled to 5s. per cent. dividend for every penny below the standard which they reduce the price, and the South Metropolitan Gas Company in London at the present time are charging 3s. 2d. for this half year, and for the half year just gone they can declare a dividend of 11 per cent., or, if they prefer, carry the excess to a reserve-fund. In the present case the company are hampered with a contractor. If they were not so hampered they would adopt the latter plan, and benefit themselves, but I do not know what the arrangements may be between them and the contractor, or whether a restriction was placed upon putting the whole of this surplus into their pockets. If the committee give them the standard price which, without opposition, was inserted in the House of Commons, the consumers would suffer; in fact, they would suffer either way. The company by the Bill get a higher standard price than has been allowed under parallel circumstances in any Bill in Parliament this session, so far as I know. In the Epsom and Ewell case, in which I was concerned, the profits were limited by a clause. That Bill was heard before Mr. Plunket in the House of Commons, and I have here the remarks made by that gentleman on consideration of a clause submitted by Mr. Michael. The chairman's attention was drawn to the fact that the works were to be let to a contractor.

Mr. MICHAEL: To a lessee.

Witness: To a contractor, but call him a lessee if you please. The chairman said he wanted to see whether the proposed clause precluded the danger he apprehended, that two profits would be earned, and Mr. Michael said the clause was for the express purpose of limiting the whole amount to be divided, whether with the manager, the contractor, or the shareholders, within the sum the committee limited it to. Mr. Michael also said it would be quite impossible for the contractor to earn any other profits, because the total dividend was to be paid as between the contractor and shareholders. The chairman said he wanted to secure that it would be impossible for the contractor to put into his pocket any profits which might, with the dividend, exceed the sum permitted by the committee, and so the discussion went on all through.

Mr. MICHAEL: Would you inform the committee that there the contractor, as you call him, guaranteed a certain per centage totally different from this case? He guaranteed year by year a certain per centage of profit.

Mr. SOMERSET (to witness): Are you aware that, under the agreement of 1858, 6 per cent. minimum is guaranteed?

Witness: That is all gone away.

It was originally 6 per cent. in this case?—Yes, I know the circumstances both of the agreement between the Waterford Company and their contractor, and of the contract between the Epsom and Ewell Company and Mr. Jones. He, in that case, undertook to pay the shareholders of the company a certain rate of dividend progressively year by year, and in this case the contractor agrees to supply the company with gas at the consumer's meter at a certain sliding scale of price, in which there is an uncertain element of profit. What profit or what loss there may be I cannot tell; there are no figures whatever given to us in the account to enable us to tell the profits the contractor has earned, and it is an unreasonable thing to suppose that he will carry on a business of that kind without making a profit. I know Mr. Anderson far too well to think that he would hold to a business out of which he did not make a profit. If he has not done so, he must look to do so in the future, and this committee are legislating for the future, and not for the past. I think a clause should be inserted to the effect that no compensation or payment be made to any of the persons contracting, except out of the amounts available for dividend.

Mr. SOMERSET: If this Bill passes, you submit that a clause to that effect should be introduced, or else a very large profit, exceeding 10 per cent., will come to the contractor and the company together?

Witness: With the standard rate as it is, it must inevitably come to the contractor or the company, or both. At any rate, it will come out of the consumers pockets. There is nothing in the accounts for either 1874, 1875, or 1876 which will enable me to discover what was the amount of the profit. The first item of expenditure is the payment to Messrs. Anderson and Jones of a lump sum, which may cover a very large amount of profit, or it may entail a loss. Besides that there are extensions and improvements charged. Those items ought to be charged to capital account, but they are charged against revenue. The fact is the company have been for some years without capital, and they have been extending their works out of revenue, and making consumers of gas pay year by year for the extension of their plant. I exclude the £5000 floating capital from my calculation.

Mr. SOMERSET: Is it a right thing, looking at the law in these matters, that they should charge interest upon that sum, and call it floating capital, when they have expended all their capital?

Witness: I do not mean to say it is not a right thing in an account brought to show what the losses and profits are. I think it is a perfectly right thing in that way, but it is not a right thing to charge interest upon floating capital in addition to dividend, because the capital employed as floating capital, when a company have the conduct of a business, is share capital, or it may be borrowed money.

Examination continued: In the 1874 account a balance was brought forward of £852; it 1875 it was £648; and in the next year £641. It is a reducible balance, and has been drawn upon for general purposes. In addition to that there is the reserve-fund of £1047.

Mr. SOMERSET: I will assume for a moment that there is technically not a lease but an agreement; what, in your opinion, is that with regard to the views of Parliament?

Mr. RICHARDS: Is this gentleman to give his opinion upon the views of Parliament?

Mr. SOMERSET: Practically, what effect has it upon the consumers?

Witness: It is, in fact, introducing a middleman who takes a profit himself over and above that which appears on the face of the accounts, and of which the consumers and the public know nothing. The form of account prescribed in the Gas-Works Clauses Act, 1871, directs that all the particulars as to the quantity of coal, the cost of coal, the money paid for wages, management, rates and taxes, and to the directors, and for every single purpose, shall be specified, so that no profit could go to any manager or contractor unless it was stated under the head of "contractor" or "manager" so much. Now the sum put down in that estimate of Mr. Jones in 1874, namely, £400 for the manager for Waterford, is a very fair sum to give in the way of salary to a manager. A company would get a well-skilled manager for £400 or less. At Londonderry I think they pay £400. They do not employ an engineer, and they are as excellent works as ever I saw in my life, and as well managed—better managed than these a good deal.

It is the contention of the promoters that these works are well managed?—I do not call them so by the results. I judge of the management of works by the results, and when a man sells 8000 feet only from a ton of coal, I say the works are not well managed; if they were, he would sell 9000 feet or more.

They would be managed in the same way by Mr. Dunskill, whether Mr. Anderson came down once or twice a year or not?—The works are not any better managed by Mr. Anderson going over them occasionally.

According to his own calculation, it is £100 a visit if he went there four times a year, and that is all profit out of the consumers. With regard to raising capital, the auction clauses are put forward now as a cure for everything—what is your view of them?—The auction clauses are very good indeed, and I have advocated them for many years. I have succeeded in getting them introduced into more Bills, until they became general by a Standing Order of the House of Commons this session, than any one else has done; but there is a flaw in the auction clauses as framed now, and is introduced so that the intention of the auction clauses may be defeated. The intention of those clauses is that the share capital, being put up to public auction, shall be sold at a premium, which shall give to the purchaser a safe 5 per cent. upon his investment, so that £100 of share capital in a thoroughly safe gas company would bring £140 if put up to auction to the public under proper conditions—£100 at 10 per cent. would bring in £200, the £100 in either case being entitled to dividend, and the premium going to the extension of the works, but not carrying profits. But there are two ways in which the intention of the auction clauses may be defeated as they are drawn and inserted in this Bill. Supposing the whole £16,000 were issued at once, and the company decided to call up only £1 per share, or £1600; or supposing they want £3200, and they call up one-fifth——

Mr. RICHARDS: I will take your lordship's opinion as to whether it is open to discuss in this House these auction clauses. They are not suggested by us, but are imposed by Standing Order.

After some discussion, the CHAIRMAN said the committee would be rather glad of the information.

Witness: I can only tell your lordships that it has been done, and that the clauses which appear here were very considerably altered in the Ashton-under-Lyne Gas Bill the other day.

Mr. SOMERSET: Will you kindly go on with your illustration as to how

these clauses might be defeated, suppose they call up the whole £16,000, but only want £2 or £1 per share?

Witness: Suppose they issue the whole of the £16,000, but only call up £1 or £2 per share—say £1 per share—the purchaser of any share would not give them £4 for that share—a share is £10—because he would have £4 lying dead, and bearing no interest to him if the company called up only £1 per share. What he would give would be 25s. instead of £4, and then he would have 6 per cent. upon his money. That is one way in which the intention of the Legislature may be defeated. Another way is this—supposing the company were to issue the whole of the capital in one lot—and there is nothing to prevent them doing either of the things I mention, either issuing the whole of the capital, and calling up £1 or £2 per share, or issuing it all in one lot—there would not be a purchaser in Waterford to buy the lot of £16,000, and then it would be open to them (I do not say that they would do it) to form a syndicate amongst themselves to buy up all the lot amongst themselves, and distribute them amongst themselves, and so they would have the whole of the new shares at par, still keeping the proprietary exactly as it is. The intention evidently here is that a number of individuals resident in Waterford shall come and acquire an interest in this gas company, and that can only be done by requiring the insertion of a proviso in the clause which enables the company to issue these shares under such conditions as they think fit. The conditions must be specified to some extent, and I think in this way. In clause 9, which is the clause under which the new C shares are to be disposed of, the company are to offer those shares "for sale by public auction or by tender in such manner, at such times, and subject to such conditions of sale as the company shall from time to time determine." I should introduce these words: "Not more than ten shares shall be offered in each lot," and that one of the conditions of the sale should be, "that the whole amount of each share so offered shall be paid by the purchaser, together with any premium attaching thereto, within three months from the actual day of sale." By the introduction of that addition to the proviso I think the intention of the Legislature will be secured.

Mr. RICHARDS: What position are we in? My learned friend has proposed a clause; does he abandon his opposition to the preamble?

Mr. SOMERSET: Certainly not.

Witness: I could give numerous precedents for limiting the number of shares.

Mr. SOMERSET: With reference to the audit, do you consider it advisable that the company or the corporation should appoint the auditor?

Witness: The rule undoubtedly is that the company should appoint their own auditor. But in very frequent cases in the country, where local authorities have opposed, a clause has been inserted, giving the corporation power to appoint an auditor, and to pay him themselves, and the two join in the audit. In the Metropolis the Board of Trade appoint an auditor to audit the accounts of the gas companies, and the dividends are not paid until the official auditor has absolutely signed and certified the accuracy of the accounts.

Cross-examined by Mr. MICHAEL: I consider the benefit attaching to having an auditor appointed by the corporation to be that it makes matters go on more smoothly between the parties, but I do not attach much importance to it. I do distinctly and deliberately say that the Act of 1847 does not give efficient protection as to examination of the books and accounts of the company.

Mr. MICHAEL: If you were appointed by the Court of Quarter Sessions to examine the books and accounts of the company, could you not arrive, under the Act of 1847, at all the information required, to see whether they had paid more than 10 per cent.?

Witness: I could; and I actually was appointed in connexion with an accountant at Birmingham to inquire into the Wolverhampton accounts years ago. Of course, everything was laid open to us, and our labours were very easy; but when we came to the Court of Quarter Sessions there was a hitch which may always arise, and that is, that the Court can make no order reducing the price of gas, even though you show it is not a proper price, and that it should be reduced, unless the reserve-fund is full. First of all the maximum dividends must be paid, and then the reserve-fund must be full, and thirdly that reserve-fund must be properly invested; and unless all those three things are done, you cannot get the order of the Court of Quarter Sessions for the reduction of the price of gas, and you cannot compel a company to invest their reserve-fund.

When you were lessee of gas-works, did the auction clauses operate prejudicially to the consumers?—I do not think so. The price at which I was required to sell gas was defined in the lease.

Do you think a small company would be able to manufacture gas cheaper than a gentleman of the experience of Mr. Anderson?—If Mr. Anderson were resident on these works I do not think they could possibly have a better manager; but it would not be worth Mr. Anderson's while to reside there, and I do not think the works would be more cheaply, better, and more efficiently managed by a man at £400 a year—a competent gas engineer—than they are at the present time. I have a son managing larger works at a considerably less salary.

Let us assume that upon the passing of this Act, and, we will say, the abrogation of the agreement altogether, the works falling back into the hands of the company and they manufacturing gas instead of the contractor, what floating capital would be required in order to carry on the works?—We allow about one-third of the annual expenditure after deducting the income from residuals, and the remainder is working capital. The annual expenditure here in 1874 was about £5700, and I have taken one-third of that—£2000.

Is it not usual to allow one-half?—No. In valuing for rating purposes we do not take one-half; we should be thrown over immediately if we did.

I will take your £2000—that would be rated at 7 per cent. dividend?—No, it would not, but it would be rated to pay 5 per cent.

That is under the auction clauses?—Yes.

Then the benefit of the auction clauses comes in at once?—Yes.

Cross-examination continued: With regard to my alteration of Mr. Jones's figures from 27,853,000 to 28,374,000 feet, it works out better for the company if they would only see it. The former worked out to only 7800 feet per ton, and I have taken a quantity which works out to 8000 feet to the ton. I have not taken an improper division, but I have taken the figures given in yesterday. Mr. Jones's figures were from June to June, while mine were for the whole year.

Mr. MICHAEL: Have you not credited us with a total quantity of 3805 tons, and if you had worked it out would it not have come to 70 tons more?

Witness: I do not think it would; at all events, it would not come to the 4000 tons mentioned by Mr. Anderson yesterday. If, however, you put the 70 tons of coal, and deduct 40 per cent. for residuals, and divide that among 30 million feet of gas, you will find what an infinitesimal fraction of a penny it makes.

It makes about 2d.?—It makes nothing of the kind.

Have you put down anything for increased capital, which would be required if Mr. Anderson were swept away altogether, and the company undertook to make the gas?—I have taken the present state of things, for the increased capital which is to be invested for the increased business will bring its own profit.

But at the present moment do you acknowledge that a working capital of £2000 must be found at once?—That must come from somewhere, no doubt, and would amount to £100 a year.

But every £100 a year is of importance, is it not, when you have only got £1900 as the total that you put down, and £400 to be added for the management?—I take the present state of things, and say the increased capital will bring its own reward.

Cross-examination continued: In stating that the cost of gas should be 3s. 3½d., it does not enter into my mind for a moment what the company may contract with the contractor at. In the first place, I have taken Mr. Anderson's own figures, and I know positively that coal can be taken into Waterford for less money by nearly 2s., and then I believe the residuals will realize more than 40 per cent. I have not been there lately, but I know the cost at the time and the cost of freight. Anybody connected with such things can have as much means of knowing as Mr. Anderson himself.

Mr. MICHAEL: Did you not lately tell a committee on a gas Bill, in reply to a question, "I think in all Bills passed through committee this session, both before committees on opposed Bills and unopposed Bills, 10 per cent. has been fixed as the rate of dividend upon new shares to be offered by auction"? Then the 7 per cent. in this Bill ought to be increased to 10 per cent.?

Witness: As far as I am concerned, I should say it was quite immaterial, because a 10 per cent. dividend-bearing share, if put up to public auction in a proper manner, would bring double its nominal amount.

Then it does not matter to their lordships whether they put 7 per cent. or 17 per cent. on the new capital?—No; only their lordships must take care that the shares are properly put up to auction, and that there must be no probability of the shares being distributed among the shareholders.

Cross-examination continued: In fixing the initial price at 4s. 6½d., it is without reference to any new capital; neither is anything put down for the cost of obtaining this Act, as that is never done. The 4s. 6½d. is sufficient to pay the maximum dividend and all the working expenses.

Mr. MICHAEL: What do you depend on in a gas company for getting the premiums on shares?

Witness: On the stability of the company—partly on the rate of dividend they are paying.

Therefore, if you reduce the company to such a condition that they pay no dividend, are you not cutting off your own profit?—I should think the surest way to reduce the company to that condition would be to let the works to a contractor, who would be sure to look after himself.

Although the contractor be Mr. Stevenson himself?—Yes; I think it is altogether improper.

Re-examined by Mr. SOMERSET: Mr. Anderson is perfectly justified in seeking to have this profit and keeping it. It is not that gentleman but the company who are seeking to act illegally. The company practically hand over all their functions to Mr. Anderson. Of course, they reserve to themselves the right of fixing the price of gas, and the right of making outlays of money; but that is done in all leases. On the other hand, they are indemnified against all the cost of manufacture, distribution, accidents, &c., and all trouble. It is just like going to a jobmaster, and saying to him, "You keep this horse for me at so much per year," and my paying a smart sum for it, rather than being at the trouble of buying my own hay, straw, &c. With regard to the price of coal, I deny that there is any error in my figures.

Mr. SOMERSET said that Mr. Stevenson had prepared his calculations upon the evidence given before the previous day; but then when a fresh calculation was put in by Mr. Anderson, he very properly based his evidence upon those calculations.

Witness: I had no means of knowing what the quantity of coals was for the whole of the twelve months in the year 1874, and so I took the same ratio as had been given in the paper by Mr. Jones. There may be, of course, an error, which the other side, having possession of all the figures, know; and I am quite prepared to admit, if they push the question, that there is £70 in my calculation against them, which would be the fraction of a halfpenny per 1000 feet. If one gets accurate data one can make accurate comparisons.

Re-examination continued: Being a lessee under a non-statutory company is a very different thing to being under a statutory company. If the consumers are not satisfied with a non-statutory company, a rival company can appear in the same place, or the consumers may say, "You shall not break up the streets;" and so stop them. But a statutory company have a monopoly, regulated by Parliament; and I feel quite sure that Parliament never contemplated that the conduct of the gas-works should pass out of the hands of the proprietors altogether, into the hands of a contractor.

Mr. SOMERSET having addressed the committee on behalf of the Corporation of Waterford,

Mr. RICHARDS was heard in reply.

The counsel and parties were then directed to withdraw. On being re-admitted,

The CHAIRMAN said the committee were ready to pass the preamble of the Bill. They thought the consumers would be sufficiently protected by being under the Act of 1871. The committee thought the price named in the 25th section was too high, and wished it to be reduced to 5s. 9d., subject to the same discount as named in the section.

On clause 3,

Mr. SOMERSET proposed the addition of the following proviso:—"Provided nothing contained in this Act shall be read or construed as altering or repealing section 33 of the Act of 1858."

The CHAIRMAN said the committee declined to insert the proviso.

On clause 8,

Mr. SOMERSET proposed that the new capital should be £10,000, instead of £16,000.

The CHAIRMAN said the committee decided to allow the clause to remain as in the Bill.

On clause 9,

Mr. SOMERSET proposed to insert the words—"Not more than 10 shares shall be offered in each lot, and that one of the conditions of sale shall be that the whole amount of each share so offered shall be paid by the purchaser, together with any premium attaching thereto, within three months of the time of sale."

Mr. RICHARDS objected to the clause, as deviating from general legislation.

The CHAIRMAN said the committee would not accept the amendment.

Mr. SOMERSET then proposed a new clause (14A): "In computing the standard rates of dividends there shall be included therein the profits made by any person or persons with whom the company have contracted or may contract for the management of the company's works and business, and in rendering the accounts prescribed by the Gas-Works Clauses Act, 1871, no other sums shall be charged by the company than would be chargeable if no such contract existed; and no compensation or payment to any person or persons, so contracting as aforesaid, shall be paid except out of the amounts available for dividend as aforesaid."

Mr. RICHARDS objected to the proposed clause, and said that, if it was shown that the company were making more than the profit allowed, the Court of Quarter Sessions could compel them to reduce the price of gas.

The Chairman said the committee thought the consumers were sufficiently protected by the Act of 1871, and would not accept the clause.

Mr. Somerset proposed another clause, giving power to the corporation to appoint and pay an auditor of the company's accounts.

Mr. Richards objected to having an auditor appointed by the corporation, and stated that, if their lordships deemed it necessary that an auditor should be appointed, it should be by the Board of Trade.

The Chairman said the committee were of opinion that an auditor should be appointed by the Board of Trade.

Mr. Somerset proposed a clause giving power to the corporation to purchase the undertaking within ten years, if authorized by Parliament so to do.

Mr. Richards opposed the clause, on the ground of its being compulsory.

The Chairman said the committee would accept the clause, the number of years being altered from "ten" to "three."

Mr. Somerset brought up a clause providing that an auditor should be appointed by the Board of Trade. This was inserted in the Bill.

The preamble was then read and agreed to, and the chairman was directed to report the Bill, as amended, to the House.

Legal Intelligence.

COLCHESTER COUNTY COURT.—Friday, Aug. 17.
(*Before* J. T. Abdy, *Esq.*, *Judge*.)

WRIGHT *v.* THE COLCHESTER GAS COMPANY.

The plaintiff in this action, the landlord of the "Woolpack" Hotel, St. Botolph Street, sued the defendants for £19 19s., damages arising out of an alleged trespass upon his premises for the purpose of cutting off his gas.

Mr. Thompson Smith, who appeared for the plaintiff, stated that in the year 1875 his client took the "Woolpack" Hotel, and about that time the gas company, hearing that he was to become the tenant of the house, instructed one of their officers to request that he should deposit £10 with them as security. Accordingly, when Mr. Wright one day met that officer in the High Street, the latter made the request which he had been instructed to make, and told Mr. Wright he had better see the manager. Mr. Wright replied that he would not go to the manager, but would see the chairman (Mr. Harvey) upon the matter. He saw that gentleman, and at the interview he handed Mr. Harvey a £10 note, and said that if he did not use it he should expect 5 per cent. interest upon the money, and if it was used he should expect 7 per cent., which was the dividend paid to the shareholders a few days afterwards. Mr. Harvey sent for plaintiff, and asked him to take the £10 back, as he was not authorized to receive it. Plaintiff still declined to see the manager, and three or four days after he had taken possession of the "Woolpack," a Mr. Simpson, who had since died, saw plaintiff, and said he was authorized to receive £6 10s. as a deposit for security. He at once handed over that sum on the same understanding as with Mr. Harvey. Matters went on for about a year and a half, and every quarter, as the balance became due, he discharged the amount he owed to the company, and had never been in default. After having paid for that year and a half, he thought it high time that he should have the interest which was owing on his deposit; and, therefore, on the 27th of January, in the present year, he wrote a letter to the manager, demanding 13s. the interest due. No money was paid, and on the 19th of May he wrote to the directors, saying they were aware they had held £6 10s. of his for nearly two years, and, he supposed, under the advice of their manager, would continue to do so. He informed them that he should not pay them anything so long as they retained his money. In the same letter he remarked that he was also called upon to pay a Mr. Causton's account; but that he had nothing whatever to do with that matter. He told them he was willing to give them a guarantee which should satisfy them, but must decline to have any transactions with their manager. The money was not returned; and when the June account became due, one of the clerks from the company's office went to plaintiff and demanded the sum due, which was 10s. over the £6 10s. deposited. Plaintiff immediately tendered the difference, but the clerk refused to accept it. The clerk went away, but returned subsequently, and took the balance due beyond the £6 10s., and gave a receipt. Directly after that a notice was served upon plaintiff, to the effect that, pursuant to a resolution of the directors, unless a fresh deposit of £6 10s. was paid on or before Thursday, the 5th of July, his supply of gas would be discontinued, as was provided for in their Act. Plaintiff did not deposit the money; and on Friday, the 6th of July, when his client was at the Borough Quarter Sessions, the company sent down Mr. Burfield, one of their clerks, and a working man, and, against the wish and order of plaintiff's wife and daughter, entered his house and cut off his gas. He had previously seen Mr. Burfield, and told him that if he was going to cut off the gas he must not enter the house. His client's wife and daughter would, moreover, state that they requested the individuals who had just been mentioned not to enter the house, and upon that Mr. Burfield left. He shortly afterwards returned, however, and said he had been to the office, and the manager had instructed him to do his duty, and thereupon they went into the house and cut off the gas. The plaintiff's claim was for £19 19s.; and as the judge might think that was rather a curious sum to sue for, he might explain that plaintiff thought the company would not hesitate at expense, and he fixed the claim at that amount to avoid the costs if the verdict was adverse to him. He submitted that plaintiff had a cause of action for two reasons—first, that the company had no right whatever to ask for a money deposit; and, second, that they had no right to enter the house and cut off the gas.

The Judge asked if the gas could be cut off in any other manner?

Mr. Smith said he should show that it was the constant and usual practice to cut off the gas from the main in the middle of the road.

Mr. *Abraham Wright*, the plaintiff, said: I am the occupier of the "Woolpack" Inn, in this town. About January, 1875, I made arrangements to take that house. I remember seeing a Mr. Chignell about that time in the High Street. He told me that the company would require from me a deposit of £10. I asked why they wished for it, and he said he was instructed to tell me so from the manager. I expressed my surprise, and said I should go and see Mr. Harvey, the chairman of the company. I went and saw Mr. Harvey the same day, and he said that personally he should have no objection to trust me for any amount; that no doubt they would have their money, but would I go and see the manager. I said he was a stranger to me, and I should decline to do so. I also said that if the company were to have £10, I would leave the money with him. I then took the money from my pocket and asked him whether £10 would be enough. It was two £5 Bank of England notes. When I gave him the money I said to him, "I shall expect interest." He said, "Then I take it on those terms." Some few days after that I met Mr. Harvey in the police court, and he asked me if I would go to his office, as he wanted to speak to me. I went, and he said, "I find, Mr. Wright, I can't hold this money of yours as chairman of the board. Will you take it back?" I said, "Oh, yes, if you please, I will." He gave me the same two notes back. I heard no more of the matter until I took possession of the house on the 6th of March, 1875. On the morning I took possession the late Mr. Simpson, who was employed by the company, came to me and said he wanted £6 10s. from me. I said, "Why not make it even money, and have the £10 again?" He said £6 10s. would do, and I gave him £6 10s. I said, "You take this on precisely the same terms as Mr. Harvey had the £10." He replied, "Yes; I suppose I do." He gave me a receipt "as per account rendered for deposit." For a year and a half after that time I paid my ordinary gas accounts as they became due. On the 27th of January of this year I sent the letter produced to the manager, asking for the 13s. interest due to me on the £6 10s. I had deposited. On the morning of that day the clerk from the office brought me a notice that unless I paid the gas account on or before Wednesday morning the gas would be disconnected. There were several customers in my bar at the time, and I was annoyed; but I paid the money immediately, and wrote the note produced. No attention was paid to the note, and on the 19th of May I sent another letter to the directors. [This letter was read, and was to the effect that they were aware they had held £6 10s. of plaintiff's for nearly two years, and he supposed, acting under the advice of their "young manager," would continue to do so. He objected to that course, and declined to pay whilst they held any of the cash. He also said that he was called upon to pay Mr. Causton's account, with which he had nothing whatever to do. He expressed his willingness to come to an arrangement with them for guarantees which should perfectly satisfy them.] After that I saw Mr. Burfield in the ordinary course of his collection. I said, "We will not have any angry words about the matter, but you must understand that I decline to pay until my deposit is exhausted." He said, "Very well." After the June quarter was due I saw him again. He still asked me if I adhered to my former determination, and I said, "Yes."

The Judge: This looks like a weak case.

Mr. Smith: Our case is that after the £6 10s. was returned that transaction ended. With regard to the trespass, Mr. Smith said he should prove that the defendants entered the house without the consent of the occupier. That being so, he should argue that it was a trespass.

The Judge: That depends upon the construction of the Act. If the other side went in by permission there would be nothing, in point of law, to argue about. If it was without permission, then it became a point of law.

Witness (continuing): Burfield came the next day and put the same question, and I again said, "Yes." On my refusing to pay, he said, "We must settle." We then went into a private room, and he gave me a receipt for the money, and took the first deposit-note which he had given me. I think the difference was 10s. 6d. The account was £7 0s. 6d. in all. He gave me a note [produced] dated June 27th.

The note referred to was as follows:—

Colchester Gaslight Company. Last Application.

Sir,—Pursuant to a resolution of the board of directors, I hereby give you notice that unless a deposit of £6 10s., in respect of the consumption of gas at the "Woolpack" Hotel be paid on or before Thursday, the 5th of July next, your supply of gas will be discontinued, as directed by the company's Act of Incorporation.

I am, Sir, your obedient servant,

To Mr. A. Wright. John T. Browing, Manager.

When I read that I said we would have no words about it, but if the gas was cut off they must not come on to my premises to do it. He replied, "All right; I am sorry to have to serve you with this notice, as I have known you so long, and you have used the gas so many years." On Friday, the 6th of July, I was at the Borough Quarter Session. Whilst I was there I received a note from my daughter, and in consequence I went home as soon as the Court was closed. When I got home I found that the gas had been cut off during my absence. I and my father have burnt the company's gas ever since it was introduced to the town. I was for some years in the employ of the company. On several occasions I have known the gas to be cut off from the outside of business premises. That was in cases where the occupier would not allow the company's servants to enter the house. No damage was done to my premises by the action of the company. In consequence of the gas being cut off, we were obliged to obtain light by other means. I had to get lamps to replace the gas. I had replied to the notice Mr. Burfield had given me on the 27th of June.

The reply referred to was put in, and was as follows:—

To the Directors of the Colchester Gas Company.

Gentlemen,—The individual who wears the white "I'm afloat," and drives the pony in buff has again threatened that unless I pay, on or before Thursday, the sum of £6 10s., my gas will be disconnected.

In my last letter to you I told you I should not allow you to hold my money any longer. This I adhere to, and I at the same time said I would give you such guarantee as would be perfectly satisfactory to you. I now refer you to Messrs. Round, Green, and Co. I might name scores of other friends, but I hope sufficient is now done, and that I shall not be subject to any more annoyance from the paltry individual I speak of. In conclusion, permit me to refer you to the 53rd and 54th sections of the Colchester Gas Act, 1866, by which you will see your position as plainly as I have been able to see mine.—Yours, &c.,

A. Wright.

Colchester, July 4, 1877.

Witness (continuing): I received a reply to that letter. [This reply, which was put in, was from the manager of the company, who said he was desired by the directors to say that they were willing to accept a sufficient guarantee; but that the persons named in plaintiff's letter declined to be responsible.] In reply to that I wrote, demanding a supply of gas from the company. Shortly afterwards I obtained Mr. Edward Death as guarantee, and the next day the company re-connected my pipe with the main. From the 6th to the 21st of July I was without gas.

Cross-examined by Mr. Croome, who appeared for the defendants: I believe it was January, 1875, when I saw Mr. Harvey, but I do not know the exact date. We were alone during the interview. I mentioned interest when I gave him the notes. He took the money, and we joked about the matter, and were very friendly. Between that time and this year I paid my gas-rate punctually. On the 27th of January the last quarter's rent was paid. I believe that was the first application. I did not pay the March quarter until I paid the June. At the time the £10 was deposited, that was not intended for the house and stables. I do not know why the sum was reduced to £6 10s. It was not because I had got the stables. The large stables were taken off my hands. I never knew that the company had a form of request to have gas laid on. Whilst in their employment I never saw one.—A form of request was put in, but witness said: I have not the remotest idea of having signed it, and I did not know what I was signing. I never read it, and it was not read over to me. [On the back of this paper was a printed notice to the effect that the premises were always to be accessible to the company's servants for any purposes connected with the pipes and mains, and, among other things, for the purpose of cutting off the gas in case of payments being in default.] I positively swear I never signed one of those papers before. I was a collector to the company, and occupied that position for two years. I remember, while I was collector, that the supply of gas was cut off outside a house in Magdalene Street. That is nearly eight years ago. The tenant had not then left the house. There was another case of a house in High Street, where the occupier, the late Mr. J. Z. Peggs, would not allow the men to go into the house. I do not know of more than a score disconnexions in Colchester which were done in the same manner as mine. I do not know whether the consumer would have to pay for having the

road up. In 1874 I filed my petition, but paid all my creditors in full. In January, 1875, I will swear I did not owe the company 7s. for coke. I was not asked for payment of that sum for coke supplied by the company.

Re-examined: I positively swear that the conditions printed on the notice were not read either by me or to me.

Mr. CROOME, for the defence, admitted, to facilitate the progress of the case, that the company's servants had entered the plaintiff's premises against his will, but submitted that they were only using their powers in doing so.

In the further course of the argument, Mr. SMITH contended that a money security was not a "reasonable security," and was not contemplated by the Act at all. If that were so, such a company might become possessed of £10,000, £15,000, or £20,000, without having to pay interest upon it. Very great importance was to be attached to the phrase "reasonable security;" and he contended that the security which the company required was not reasonable. The Act of 1871 called upon the consumer to give security, but nothing was said about a deposit or payment of money.

The JUDGE: The Colchester Gas Act of 1866 defines the security as "reasonable;" but the Gas-Works Clauses Act of 1871 enlarges their powers, and says they may take security.

Mr. SMITH: The very security they have at the present moment they could have had then.

The JUDGE: Security does not mean a guarantee. Surety applies to a person, security to a thing. The plaintiff did not give them anything.

Mr. SMITH: He gave them a security, which they accepted.

The JUDGE remarked that plaintiff was willing to give security in the first instance, but because the company required it again he conceived he had a wrong. The Act used the words "reasonable security," and left the company to say what that meant.

Mr. SMITH said the company alleged they had acted under section 11 of the Gas-Works Clauses Act of 1871; whereas, he contended, it was their duty, under section 57 of the Colchester Gas Act of 1866, to have gone before a justice, and got the security assessed.

The JUDGE: Do you really mean to say that the word "security" does not mean pecuniary as well as personal?

Mr. SMITH: I say it is not a reasonable security, and that it should not be a monetary security at all.

The JUDGE: It is not above the average of the six months' supply. It was plaintiff's own fault that he lost his money and interest. The company were willing to accept security. They had an intimation from him that he was ready with a personal guarantee, and then they were satisfied with that. It comes to this, what does "security" mean; and what is "reasonable security"? I say, beyond all doubt, it means either personal or pecuniary. Reasonable security means a sum not beyond the limit of the liability or debt which the person may contract. The possible debt here was £7 10s. per half year. Therefore if the company say, "We shall be satisfied with the responsibility and guarantee for £6 10s.," they are perfectly reasonable in accepting the offer. There is nothing else in the whole case. I will make a note of Mr. Smith's objection—that security may consist of a deed or document, as well as a personal guarantee. I decline, however, to note an objection that plaintiff was not made aware of the conditions on the back of the agreement or contract which he signed.

Mr. SMITH further objected that, under one of the Acts, the gas could only be cut off in the house when the meter there was the property of the company. He said he did not want damages; but protested that defendants had no right to enter upon plaintiff's property against his wishes, unless the meter belonged to them.

The JUDGE: I must say, if plaintiff signs the agreement he is bound by all the terms of it. He ought to have read it. I shall give judgment for the defendants, with costs. I am dead against the plaintiff, and must say that upon the contract he has lost. First, he was bound by the contract; secondly, defendants possessed power to enter the premises to disconnect the pipe; and third, there was no trespass.

Judgment for the defendants accordingly.

WOLVERHAMPTON POLICE COURT.—MONDAY, AUG. 20.

(*Before Messrs.* MORETON *and* TWENTYMAN.)

ALLEGED THEFT FROM THE GAS-WORKS.

William Fry, glazier, late of North Street, was brought up under remand charged with stealing a quantity of brass and copper tubing, the property of the Wolverhampton Gas Company, in the year 1875.

Mr. MANBY appeared on behalf of the gas company, and Mr. R. A. WILLCOCK for the prisoner.

It appeared that in December, 1875, the prisoner took a quantity of old brass and copper tubing to Mr. William Evans, brassfounder, School Street, and offered it for sale, stating that his name was Fryer, and that he was a plumber and glazier, carrying on business in Piper's Row. He left the basket containing the metal, and was told to call again in the course of an hour. In the meantime, inquiries were made, by Mr. Evans's clerk, in the town, and on prisoner returning he admitted that his name was Fry, and that he lived in North Street, and said he would take the metal back to the company. He was not allowed to do so; but, after he was gone away, Mr. Annan, manager of the gas-works, called and identified the metal, and a warrant was afterwards issued against the prisoner, who immediately absconded, and was only recently apprehended, at Wednesbury. The metal, about 78 lbs. weight, was detained until last Christmas, when, with the permission of the gas company, it was melted down, with the exception of a few pieces, which were now produced for identification.

Mr. WILLCOCK cross-examined with a view to show that prisoner had worked for himself, and had thus obtained the metal.

Prisoner was committed for trial at the sessions.

DEWSBURY, BATLEY, AND HECKMONDWIKE WATER-WORKS.—The arbitration for the sale of Batley's share in the old water-works to Dewsbury and Heckmondwike was formally opened at the Westminster Palace Hotel, London, on Thursday morning, Aug. 16. The umpire is Sir Henry Arthur Hunt; the arbitrator for Dewsbury and Heckmondwike is Dr. Pole; and the arbitrator for Batley is Mr. Hawksley, C.E. The council engaged on the part of Dewsbury and Heckmondwike are Mr. Pope Q.C., and Mr. Michael; and on behalf of Batley, Sir Henry James, Q.C., and Mr. W. Shaw, of Leeds. The arbitrators, council, and witnesses on both sides having assembled, and being apparently ready for opening the proceedings, Sir Henry James (leading counsel for Batley) stated that his clients were not prepared to go on with their case, and asked for a further adjournment. They required further evidence and further calculations to be made before they could complete their case, and on these grounds he asked for an adjournment of the proceedings. Mr. Pope said he should not object to the application, providing the Batley Corporation agreed to pay the expenses incurred on the part of Dewsbury and Heckmondwike. This was agreed to, and the proceedings were then adjourned until Tuesday, the 13th of November. The cost of Thursday's proceedings, which did not occupy more than a quarter of an hour, will probably amount to the modest sum of £1000.—*Batley Reporter.*

Miscellaneous News.

ON A NEW UNIT OF LIGHT FOR PHOTOMETRY.

By A. VERNON HARCOURT, Esq., F.R.S., &c.,
One of the Metropolitan Gas Referees.

[A Paper read before the Physical and Chemical Sections of the British Association, at Plymouth, Aug. 17 and 20, 1877.]

If we compare the corresponding operations of photometry and calorimetry, we have for the latter an unexceptionable scientific unit in the quantity of heat that will raise the temperature of a weight of water from the point of freezing, or of maximum density, through one degree. We have also a serviceable practical unit, for the comparison of various fuels, in the quantity of heat that will evaporate a pound of water. But for photometry there is no accepted scientific unit, nor even any sufficiently good practical unit for comparing different modes of illumination, or fixing the bargain made between gas companies and the public.

The unit which is actually employed for expressing and estimating the illuminating power of coal gas is defined by Act of Parliament to be "a sperm candle of six to the pound, consuming 120 grains of sperm per hour." One advantage the adoption of a candle as a unit has. It is generally intelligible. Every one has an impression of the amount of light which a candle gives; and the statement that a particular lamp gives the light of 10 candles conveys a tolerably good notion of the illuminating value of the lamp. This advantage, however, is by no means bound up with the use of candles in the operation of photometry. The name of candle might well be retained for a unit of light similar to the light of one candle, as "foot" and "grain" are employed for exact measures of length and weight, although the actual value of the unit were defined without reference to any particular kind of candle.

All who have used candles for photometry are familiar with the fluctuations and uncertainty to which their mode of burning and their varying character lead. It is only by a free use of averages that an approximately trustworthy result can be attained. Some well-devised experiments were made seven or eight years ago by Messrs. Kirkham and Sugg, with an apparatus called by them a cross-photometer, in which a single gas-flame was the central point of four candle photometers arranged crosswise, so that observations of its illuminating power might be made simultaneously by four observers. The differences in the results, after applying the usual proportional correction, where more or less sperm was consumed than the standard quantity, amounted frequently to two or three candles in the estimated value of a gas-flame of an average value of 14 candles. These experimental observations illustrate in a striking manner the uncertainty which attends the existing system of photometry; but the divergency includes the effect of other causes besides the difference between different pairs of candles, such as instrumental errors and the personal equation of the observers.

Where all precautions are taken, such as lighting the two candles, which are used simultaneously, at opposite ends, so that, their form being slightly conical, one may burn down towards the thicker, and the other towards the thinner end; when the candles are lit for some time before they are used; and when several successive observations are made, each with a different pair of candles, I find that the variations in the estimation of the same sample of coal gas rarely exceed about half a candle, or 3 per cent. Occasionally, however, greater differences occur, and the average results of single sets of observations frequently vary by more than one candle, in the estimated illuminating power, even when the same pair of candles is used.

The source of these variations lies partly in external conditions; partly in the composition, and partly in the construction of the wick, of the candles. Atmospheric pressure and temperature affect the amount of light which a candle gives. Dr. Frankland has shown that a diminution of pressure promotes perfect combustion, corresponding to an increased supply of air, and *vice versâ*; so that at pressures less than the ordinary atmospheric pressure a smoky flame becomes clear, while under an increased pressure alcohol burns with a luminous flame. Thus the effect of changes of pressure may be compensated or may be exaggerated in the photometric estimation of coal gas by the effect produced simultaneously, under different conditions or states of burning, upon the candle and the gas. When a candle-flame is long and smoking at the top, a slight decrease in atmospheric pressure would, no doubt, add to its illuminating power; when the combustion of the vaporized grease is perfect, diminished pressure would diminish the light. It has been pointed out by Dr. Heisch that with an Argand burner two different qualities of gas, burning at the same rate, may give the same amount of light—a poorer gas which the burner supplies with the quantity of air suitable for the full development of its illuminating power, and a richer gas which is burnt at a disadvantage, the supply of air being insufficient for its needs. In the first case, a small decrease in the atmospheric pressure would diminish, in the second it would increase, the quantity of light.

Differences in the temperature of the air affect the flame of a candle, by altering the distance between the bottom of the flame and the upper surface of the grease, or by keeping the cup of the candle more constantly filled with melted grease. In hotter weather a candle of a material with a comparatively high melting point, such as spermaceti, which melts at a temperature varying from 109° Fahr. to 112° Fahr., according as it is prepared in winter or in summer, gives rather more light than in colder weather. The value of the same sample of gas tested with the same pair of candles appeared to be 18·2 candles at the temperature of the room, but only 16·9 candles when the temperature of the end of the photometer in which the candles were placed was raised artificially by about 20° Fahr.

To give sperm candles a homogeneous appearance, the spermaceti is mixed with a small quantity of wax, the proportion of which is slightly varied. I am not aware whether this has any appreciable effect upon the illuminating power.

The sperm candles which are used for testing gas differ from those supplied to the public. They consume sperm less rapidly, and give less light.

The regulation of the rate of consumption is effected by varying the number of threads in the strands which form the wick. One of the principal makers of the candles used for gas-testing is now experimenting upon the effect of altering the strain upon the wick when it is fixed in the mould. A change in this respect may probably alter the curvature of the wick within the flame, and thus, perhaps, improve the light given by the candle.

A few years ago the nominal quality of the coal gas supplied to the Metropolis was changed to the extent of nearly two candles by the adoption of a greatly improved burner in the photometer. It seems possible that if similar care and ingenuity are bestowed in perfecting sperm candles, within the parliamentary definition, which leaves not only the wick but also the diameter of the candle to the discretion of the makers, an improvement of 10 or 12 per cent. may be effected, which would make the requirement of a higher illuminating power a reality.

Clearly, however, what is to be desired is, neither that the gas companies should gain an advantage by an improvement in the test burner, nor that the representatives of the gas consumers should gain an advantage by the introduction of an improved standard candle, but that the

system of photometry should be fixed upon such a basis that a contest of this kind would become impossible. A step in this direction was taken last year by the definition of the burner to be employed in testing. One of the Argand burners used in one of the official testing-places—of which there are now twelve in different parts of London, at each of which three testings are made daily of the illuminating power of the gas supplied—was measured and figured; and verified copies of this burner, which is to be exactly imitated for the future, were deposited with the Warden of the Standards, and with the Companies, and with the City and Metropolitan Board. But what is still needed is that equal definiteness should be secured for the unit of light or standard measure, which is employed to determine the amount of light which is yielded by a given sample of gas when burning as the rate of 5 cubic feet an hour at the standard burner.

Time will not permit me to do more than mention the methods which have been tried or have been suggested for this purpose. In Paris, the light with which the gas-flame is compared is a lamp consuming colza oil at the rate of 42 grams an hour. Mr. Keates has proposed the adoption in this country of a similar lamp burning sperm oil. The light of the lamp is said to be more constant than that of candles, and the operator has the advantage of being able himself to adjust the rate of consumption. But the main difficulty in the way of definition and constancy in the case of candles—namely, the variable structure and varying condition of the wick—reappears in the case of lamps, though probably the variations are less in amount, owing to the power which exists of adjusting the wick and the greater simplicity of its form during combustion.

An ingenious kind of lamp was made some years ago by Mr. Crookes, in which the two *desiderata* of known composition of fuel and definition of the wick were secured by using for the fuel a mixture, in definite proportions, of benzene and alcohol, and for the wick a bundle of platinum wires of a particular size. Unfortunately, the light given by this lamp is only a fraction of the light of a candle, and thus it cannot be used for comparison with so bright a flame as that of gas burning at any ordinary gas-burner.

Other modes of photometry which have been tried or proposed I must, on this occasion, pass by, with the remark that since the value of an illuminant depends solely upon such parts of the total force radiating from a flame as affect the human eye, no test of illuminating power can be satisfactory which does not depend upon vision; at least, until it has been proved that some other effect of radiation, such as the impulse given to the radiometer, or the increase of the electric conductivity of selenium, is for all flames in direct proportion to the effect upon the optic nerve—a relation which seems very improbable, and which cannot be established until some exact mode of measuring the visual effect has first been found.

Three conditions need to be fulfilled for the production of a standard flame. First, the combustible must be of known and definite composition. Secondly, the conditions of burning must be of a simple and definable character. Thirdly, the nature of the combustible and of the conditions of burning must be such that atmospheric changes may produce a minimum of effect upon the light. A fourth condition might be added as highly desirable—namely, that the operator should be able to verify for himself the composition of the combustible he employs. No chemist, at least, would willingly spend time upon a quantitative operation for the accuracy and significance of which he was dependent upon the care exercised by the workmen of the best maker of candles or refiner of oil.

For reasons of another kind, it is desirable that a new unit of light should be made to correspond to the average value of the existing unit, the light given by a sperm candle consuming 120 grains of sperm per hour. No change in the nomenclature of photometry would thus be required; the unit of light might still be called a candle, and gas which is described as 14-candle gas or 16-candle gas would retain its appellation, yielding, when burnt under standard conditions, the light of 14 or 16 of the new units.

After trying many different plans, an account of which would carry me far beyond the reasonable limits of this communication, I venture to think I have devised a method which satisfies fairly the conditions I have named. For the standard combustible I employ a mixture of air with that portion of American petroleum which, after repeated rectifications, distils at a temperature not exceeding 50° C. This liquid consists almost entirely of pentane, the fifth member of the series of paraffins. I have made three or four analyses of the liquid, which, though they scarcely distinguish between pentane and the adjoining hydrocarbons of the same series—the proportion of carbon to hydrogen being in pentane

Carbon	83·3	Carbon	83·7
Hydrogen	16·7	and in hexane Hydrogen	16·3

—would reveal the presence of small quantities of hydrocarbons richer in carbon. I have also determined the vapour-density of the liquid. The density of gaseous pentane, compared with hydrogen, is 36; that of hexane 43. I find the vapour-density of the liquid, distilled twice below 50°, to be 37. The lighter portions of purified American petroleum have been carefully examined by Ronalds, Cahours, Warren, Schorlemmer, and other chemists, and have been found to consist of the following hydrocarbons:—Tetrane boiling between 0° and 4°, and having a specific gravity at 0° of 0·6; two isomeric pentanes, one boiling at 30°, the other at 37°, and having at 17° a specific gravity 0·626 (Schorlemmer), 0·628 (Cahours), the proportion of which appears to vary, since the hydrocarbon separated by Cahours boiled at 30°, while Schorlemmer states that the pentane in the sample examined by him consisted almost wholly of the variety boiling between 37° and 39°; hexane, which boils at 68° C., and has a specific gravity at 16° C. of 0·669. The liquid I use has a specific gravity which has only varied in different samples between 0·6298 and 0·63, except in one case, in which, probably owing to the temperature of distillation having been allowed to rise too high, it was 0·631. A sample distilled twice at 40° had the specific gravity 0·6276. It would not be difficult, by rectifying at 40°, to obtain almost absolutely pure pentane. But I do not think it necessary to limit the distillation to this temperature, because the yield at 50° is rather larger, and it seems hardly possible that the admixture of a small and nearly constant proportion of a substance so little different as hexane can affect the quality of the liquid as a combustible. Also I find, having distilled ten or twelve samples of the liquid, using about three litres each time, that I get a constant specific gravity.

To prepare the gas, I draw into the gasholder the required volume of air, chosen according to the capacity of the holder, and corrected for pressure, temperature, and tension of aqueous vapour. The volume may be measured either by means of a meter, or by a scale upon the gasholder. Then the corresponding proportion of pentane is poured into the gasholder from a measuring-flask, connected by means of glass and caoutchouc tubing with a tap in the upper plate. If the liquid pentane comes in contact with the plug of the tap, it acts on the grease which is used to lubricate the plug, and is liable thus to cause leakage. Contact is easily prevented by placing in the mouth of the tap a piece of caoutchouc holding a glass tube, which can slide, air-tight, up or down. The upper end of this glass tube is connected with the flask charged with pentane; the tap is opened and the glass tube pushed down through the opening. When the contents of the flask have been poured through, and a minute or two allowed for drainage, the glass tube is drawn up until the tap can be closed, and then the flask and connecting-tubes are removed. The proportion which I propose to maintain between the air and the pentane is 600 volumes of air to one volume of pentane, measuring the liquid at or near 60° Fahr.; or, measuring both as gases, 20 of air to 7 of pentane, the vapour-density of pentane being such that it occupies as gas, under the normal conditions of 60° Fahr. and 30 inches barometric pressure less the tension of aqueous vapour at 60°, 210 times the volume which it occupies as a liquid.

When the pentane is poured upon the water in the gasholder with thrice its vapour-volume of air above, it volatilizes rapidly and completely. A few minutes are sufficient for the volatilization of the liquid, and a few hours suffice for perfect diffusion. It is clearly essential to the uniformity of the air-gas thus made that the liquid should be free from any admixture with non-volatile hydrocarbons, which would accumulate on the surface of the water, and dissolve or give up portions of the gaseous hydrocarbons, but the fulfilment of this condition is ensured by the repeated rectifications which are necessary to separate pentane from the hydrocarbons of higher boiling point. It is also essential that this vapour or gas should be so slightly soluble in water, that the proportion in the air-gas standing over the large volume of water in the tank of the gasholder may not be appreciably affected by changes in the temperature of the water. Fortunately the gaseous paraffins are most sparingly soluble in water. I have enclosed the vapour of pentane at the tension of 261 millimètres over boiled-out water in an eudiometer for 24 hours, and 100 volumes of water dissolved only 0·92 volume of the gas. No doubt the first sample of gas made in a gasholder filled with fresh water would suffer—and I find that it does suffer—some diminution in the proportion of pentane; but the error, if standard gas is kept in store for photometry, fresh portions being made from time to time over the same water, would only be such as could arise from the difference between the solubility of gaseous pentane, under a pressure of a quarter of an atmosphere, at one temperature and at another, and this error, though real, is likely to be infinitesimal. Many, and, as far as I know, all other substances, which otherwise might be used as the luminous ingredients of a standard gas, such as olefiant gas, or ether, or benzene, are excluded by the necessity of storing and measuring gas over water, and the comparative solubility of these substances in water.

The tension of the vapour of pentane at 17·4° C. is 417 mm. Mixed with 1½ volume of air, it forms a perfect gas at a temperature of 16·8° C., and under pressures rising at least to 470 mm. A portion of standard gas transferred from the gasholder to an eudiometer, and measured at various temperatures and pressures, gave the following results:—

Conditions.		Corrected Volume.
Temperature.	Pressure.	
21·1° C.	737·4 mm.	35·7 c.c.
21·3	933·9	35·6
15·0	764·8	35·4
10·0	761·8	35·4
4·0	756·4	35·5
4·0	910·0	34·3

Thus the gas is a perfect gas, suffering no condensation or abnormal contraction until it is exposed to conditions which could never occur in practice—a temperature of 4° C., and, at the same time, a pressure of 1½ atmosphere.

A gas of constant composition having been thus prepared, the next problem is to devise a burner of so simple a construction that, with reasonable care on the part of the maker, there is no likelihood that out of a number of burners made on the same pattern there should be any difference between one and another capable of affecting the amount of illuminating power developed from the same sample of gas. For this purpose there must be no small measurements. I believe brass can be worked so that the error in such a matter as the diameter of a hole should not exceed 1-1000th of an inch. But where gas is burnt from a small nozzle even this error may be material. The diameter of the holes in the standard Argand burner is 0·045 inch. A difference of 1-1000th of an inch in the diameter makes here a difference of 5 per cent. in the area of the opening. When, as in the burner proposed to be used with the standard gas, the opening has a diameter of a quarter of an inch, its area would be affected by less than 1 per cent. by a similar error. The other measurements involved in making this burner are larger, and are less important. The length of the brass tube which the gas enters near its base is 4 inches, its diameter is 1 inch, and the thickness of the disc which forms the mouthpiece is half an inch.

Another condition which the burner needs to fulfil, as far as possible, is that of giving a steady flame. It is not easy to produce a steady flame where gas does not issue under pressure, but flows out at a slow rate through a large hole. Under these conditions a long flame is always unsteady, but by employing a rich gas it is possible to get a cone of flame short enough to be almost as steady as the flame of a candle, and giving the same amount of light. When the gas has burned for a short time the whole length of the brass tube becomes moderately heated, and this contributes to steady the flame; for the gas burns in the axis of a cylinder of ascending air, which, having a definite set, is less swayed by lateral currents. I find that with this burner, either in the box-photometer or in an open photometer, in a room moderately free from draughts, no difficulty occurs through unsteadiness of the flame.

I have here a single burner consuming standard gas at the rate of half a cubic foot an hour, and producing a flame whose height from the surface of the burner to the luminous tip, which in still air is almost as fixed and definite as the ivory point marking the level of the mercury in the reservoir of a barometer, is 2 inches and 5-16ths. The height to which the tip of the flame should reach is marked by a piece of platinum wire stretched across. Not only is the height of the flame serviceable as a check upon the preparation of the gas, since only gas which has been made with the due proportion of pentane will give a 2 and 5-16ths inch flame when burning at the rate of half a cubic foot an hour, but the regulation of the height of the flame is more important for the production of a fixed amount of light than the regulation of the rate of consumption.

I have made experiments in which I have varied the proportion of pentane to air to the extent of 10 per cent. each way. Such samples of gas give a great excess or defect of light when burnt at the normal rate of half a cubic foot an hour, but very nearly the right amount of light when the rate of consumption is neglected, and the height of the flame is adjusted at 2 and 5-16ths of an inch. I have tried also taking the usual proportion of air to pentane, but using, first, a liquid of rather higher boiling point—that which distilled between 50° and 55°; and, secondly, the purer sample of pentane, obtained by rectifying twice at 40°. The result in the latter case hardly differed from those obtained with the pentane rectified at 50°; the former mixture gave, at first, a poorer gas, some of the hydrocarbon not having volatilized, and, after the addition of some of the normal mixture of air and pentane, a richer gas. In all cases, the light was not far from the standard if the flame was set at the usual height, while the rate of consumption varied considerably.

These experiments show that if, instead of being intentionally varied, the mode of distillation and the proportion of air are kept carefully uniform, the light given by a flame of the standard length will be constant;

also that, if the sample of gas has been prepared wrongly, the operator cannot fail to discover the fact by observing that the normal rate of burning does not give the normal height of flame. Any leakage between the meter and the burner would also announce itself in the same way.

What effect the actual barometric variations produce on the standard flame I have not yet determined, nor is it known in the case of an ordinary gas-flame. It is assumed that a given volume of coal gas, measured under standard conditions, will yield the same relative amount of light as compared with candles, under any such variations of atmospheric pressure as actually occur. This, as has been pointed out, is an improbable supposition. In comparing together the gas light and the standard light, it is more likely, since both are gas flames, that they would be similarly affected by atmospheric variations. This is certainly true of the volume of the two samples of gas; and thus, provided the rates of consumption, as registered by the meters, are 5 cubic feet an hour and one cubic foot respectively, no correction need be applied for these variations.

Even if the effect produced upon the light of the standard flame by such atmospheric variations as actually occur should prove to be slight, a definition of the unit must necessarily include a statement as to temperature and pressure. The unit which I propose, and which has been adjusted to correspond to the light of "a sperm candle consuming 120 grains of sperm per hour," is: "The light given by a mixture of 7 volumes of pentane gas with 20 volumes of air, burning from a ½-inch orifice at the rate of half a cubic foot per hour, under the standard conditions of 60° Fahr. and 30 inches pressure." For gas photometry it is convenient to use two such units in order to increase the distance between the disc and the standard light.

The question of the advantages or disadvantages of the unit here proposed is distinct from the question of the correspondence between this unit and the average illuminating value of a standard sperm candle. If, as the result of a more extended comparison than I have yet made, the two are found to be not in exact accordance, a slight alteration in the ratio of air to pentane must be made; but the mean result of 30 comparative experiments made with candles and with standard gas prepared in the manner described, is

	Candles.	Standard Gas.
Illuminating power of gas with "London" Argand, burning 5 cubic feet per hour . .	18·0 ..	18·14

The average results are almost identical, but the numbers obtained with candles vary much more one from another than the numbers obtained with standard gas. I have written up as an illustration the results of the last comparative experiment I have made.

	Candles.	Standard Gas.
Value of illuminating gas compared alternately with candles and with standard gas	18·0 ..	17·6
	17·5 ..	17·5
	18·1 ..	17·6

The comparisons were made by setting the gas in an Evans photometer to burn at the rate of 5 cubic feet an hour, and placing alternately in the same position, at the opposite end of the instrument, a pair of sperm candles (applying in this case the usual corrections) and the double standard burner consuming standard gas at the rate of one cubic foot an hour.

[We understand the apparatus for Mr. Harcourt's proposed unit of light, which he exhibited at the meeting of the Association, will shortly be on view at Messrs. A. Wright and Co.'s, 55, Millbank Street, Westminster, Mr. Harcourt having arranged with Mr. Hartley to set up and show the apparatus, so that it may be seen and tried by any who are interested in the matter, on the part of either companies or consumers.—Ed. J. G. L.]

LIVERPOOL UNITED GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held on Tuesday, the 21st inst.—Mr. J. A. Tinne in the chair.

The Secretary (Mr. P. F. Garnett) read the directors report, which was as follows:—

The company's accounts which are now presented to the proprietors show the revenue for the year ending June 30 last to have been £435,140 10s. 7d., and the expenditure £362,642 0s. 7d., leaving an available surplus of £72,498 10s., from which £33,971 6s. has been taken for payment of the dividend declared last February. Out of the balance (£38,527 4s.) the directors recommend that a dividend be declared, for the half year ending June 30 last, at the rate of £5 per cent. on the ordinary consolidated stock of the company, and at the rate of £3 10s. per cent. on the consolidated B (7 per cent.) stock, and on the amount paid up in respect of the £7 10s. shares.

At the last annual meeting of the company the directors announced an intention to reduce the price of gas from the 1st of October, since which date they have had the satisfaction of making another reduction (from the 1st of July last). The price is now 3s. 9d. per 1000 cubic feet to all consumers, and the directors are not without hope of being enabled before long to effect a still further diminution of price.

The proprietors will have observed, from the newspaper reports of the proceedings of the Liverpool Town Council, that the question has been again mooted of the acquisition by that body of the undertaking of this company. The directors are far from believing that such a change of management would prove beneficial to the public; but, if the transfer to the corporation should be held to be desirable in the public interests, whatever terms may be proposed will be submitted to the proprietors for their consideration.

The members of the board who retire by rotation are John A. Tinne, Esq., David O. Bateson, Esq., Sir Thomas Earle, Bart., and Samuel H. Thompson, Esq., all of whom are eligible for re-appointment. The retiring auditor is J. R. Darsie, Esq., who is also eligible.

The Chairman said he had nothing to add to the report, which would give the proprietors all the information required, and if any one wanted further information, he would be most happy to give it. He moved the adoption of the report and statement of accounts.

The motion was seconded by Mr. J. Lister, and carried unanimously.

On the motion of the Chairman, seconded by Mr. D. O. Bateson, the dividend proposed in the report was carried.

The directors who retired by rotation, and also the retiring auditor, were re-appointed, and a vote of thanks was passed to the chairman and directors.

The Chairman, in acknowledging the compliment, said that last year had not been without considerable anxiety, but he hoped the directors would be able to weather all the difficulties which might meet them during the ensuing year as they had done in the past. Notwithstanding all that had been said out of doors, he trusted they would be able to satisfy the public completely.

The meeting then concluded.

NEWCASTLE-ON-TYNE AND GATESHEAD GAS COMPANY.

The Annual Meeting of Shareholders was held on Wednesday, the 22nd inst.—Alderman Hedley in the chair.

The Secretary (Mr. W. Hardie) read the report of the directors, which was as follows:—

The directors herewith submit the accounts for the year ending June 30, 1877. The receipts for the year amount to £124,284 12s. 1d., and the expenditure, including interest on loans, to £91,155 14s. 7d., leaving a balance of £33,128 17s. 6d., out of which the directors recommend that a dividend of 3½ per cent. for the half year be paid, making, with the 3½ per cent. paid in March last, the full statutory dividend of 7 per cent. for the year. After this there will remain £9300, out of which it is proposed to carry £2500 to the credit of renewal-fund (increasing that fund to £5000), and the balance to next year's account.

The receipts for gas are £95,482 4s. 10d., against £89,108 15s. 6d. last year, being an increase of £6373 9s. 5d. In tar there is also an increase of £1603 15s. 1d. Sulphate of ammonia has fallen off £141 17s. 1d., owing to the expense of bringing the liquor from Redheugh to Elswick; but this will be avoided next year, as sulphate of ammonia works are in course of erection at Redheugh. The receipts for coke are about the same.

As compared with last year, there has been a saving of £4809 6s. 10d. in the cost of coal; but the repairs and maintenance of works and plant show an increase of £2339 18s. 7d., and repairs, maintenance, and renewal of mains £4116 15s. 3d. These items, the directors believe, will be amply repaid by reduced leakage and increased means of supply. Part of this expenditure is for laying a 12-inch main to Blaydon, which will render separate works there no longer necessary.

During this year 30 miles of new pipes have been laid in extensions and alterations, 1879 new services have been laid, 330 old services have been relaid, 320 new lamps have been erected, and 2004 meters have been taken out, repaired, and tested.

The new works at Redheugh were opened in October last, in presence of the Mayors and Corporations of Newcastle and Gateshead, and of a number of gentlemen of experience in gas matters, who expressed themselves highly gratified with the complete arrangement of the works for the manufacture and purification of gas. It is satisfactory to know that the expectations then formed of their efficiency have been fully realized.

Taking into consideration the increased business of the company, the directors recommend that the salary of the secretary be increased from £500 to £600 per annum from the 1st of July last.

The directors, William Brown, Thomas Hedley, Benjamin Plummer, James Douglas, John Bennett Alexander, Thomas Lesslie Gregson, Ralph Atkinson, William Boutland Wilkinson, and Charles Henry Young, retire, but offer themselves for re-election. The auditors, Mr. J. H. Richardson and Mr. R. Y. Green, also retire, but offer themselves for re-election.

The Chairman, in moving the adoption of the report, said it was pleasing to the directors to be able to congratulate the proprietors on the very satisfactory year they had passed through. The year ending on June 30, had been about the most successful one experienced by the company. The whole of the works had been conducted in a very satisfactory manner. The illuminating power had been good, and the gas free from sulphur; and he thought he might say with safety that there had been fewer complaints of any description whatever during the past year than there had ever been before in his recollection. The increase during the past ten years in the works of the company had been very large indeed, and much more than many proprietors would expect to find, excepting those who had gone carefully into the accounts. In 1875 the gross receipts were £115,000. The price of gas was reduced 10 per cent., which was a very large amount, equal to £8000 to £10,000, and yet in 1876, with the decreased price of gas, the gross receipts were £117,000, and last year the amount was £124,000. The increase in the make of gas during the last ten years had been 85 per cent., which showed the necessity there was for them to extend the works in the way they had been doing, although some of the shareholders thought the directors had been going a little faster than there was any necessity for. In 1867 there was 56,000 tons of coal carbonized, and 480 million cubic feet of gas made. In 1872, 69,000 tons of coal were carbonized, and 659 million cubic feet of gas made, showing an increase of 38 per cent. In 1877 upwards of 85,000 tons of coal had been carbonized, and 889 million cubic feet of gas made, showing an increase of 35 per cent. over 1872. The total increase in the ten years from 1867 to 1877 was 85 per cent., and the quantity of gas made went on increasing at the rate of 8 to 10 per cent. a year, so that they no sooner got works completed to meet the supply for the time being, than they had to look forward to a greater extension of works to meet the increase in the consumption. The net profits available for dividend and interest had in the same ten years increased. In 1867 the amount of net profit was £14,521; in 1872, £25,000; and last year, £38,000, showing a great increase in the course of the ten years. The cost of coal in 1867 was 8s. per ton; in 1872, 6s. 7¼d.; and last year the average cost was 8s. 0¼d. In 1867, when the profits amounted to £14,000, the price of gas was 3s. 4d. per 1000 cubic feet, with 10 per cent. discount; and now the price was 3s. per 1000 feet, with 10 per cent. discount; and notwithstanding that decrease in the price, the profits had increased. The capital had been increased during the same time, but not to the same proportion, and the amount expended now was £546,828. The balance of profits last year, which amounted to £38,000, would have been several thousand pounds greater, but for the directors, looking at the low price of iron, deciding to do what was mentioned in the report—to overhaul the pipes, and to replace all the bad and injured ones. As many as 30 miles of new pipes had been laid during the past twelve months, and the plant of the company had been also very much increased; and the cost had been £6000 over the ordinary yearly expenditure under these two heads. They, however, already felt benefit from it, as there had been a considerable reduction in leakage, and every 1 per cent. reduction in leakage was 1 per cent. added to their profits; and they hoped that there would be a still further reduction in the leakage. Probably they might have a great deal of the same kind of work to do in the present year; and so long as iron kept so low in price, the directors thought it would be an advantage to the company to do this work; and they were able to effect it without interfering with the amount of profits necessary to pay dividends. Persons who understood the proper and most economical method of manufacturing gas were very much pleased with the new works at Redheugh. Those works had only been eight months in operation, but this year the company would have the full benefit of the works. So much gas was not made at the Elswick works now that the Redheugh works were in operation, but in the course of a few years both works would be kept in full operation. The directors had decided within the last month or six weeks to erect another gasholder at Redheugh, to hold one million cubic feet of gas, and tenders had been accepted for the work. They hoped, when the holder was completed, to be able to do away to a considerable extent with Sunday work. The directors had been looking forward for a number of years to dispensing with work on Sundays, but they could not do so until they got holders in which to store sufficient gas to meet the consumption. During the year there had been a sale of £25,000 worth of new stock, and the premiums amounted to £9582, which was equal to 40 per cent., so that for each £100 worth of stock, on which they paid 7 per cent. dividend, the company realized £140, which reduced the interest to 5 per cent. The works were doing well, and the directors were very well satisfied indeed with all things. The Redheugh works for six weeks had supplied the whole of the gas to Newcastle and Gateshead, and enabled the Elswick works to be closed for that time, and the pipes to be examined. They had now had all the pipes at the Elswick works cleaned out and put into proper working order. He was sorry to see from the papers that day that the illuminating power of the gas was a little less than they would like to see it. They liked to have the illuminating power equal to 15 candles by the old test, which meant really 17 candles by the "London" Argand burner. In the report in the newspapers that day, the illuminating power was stated to be equal to 13 candles; but that was accounted for by the Elswick works being out of use for six weeks, and air getting into the gasholders, and it took a little time for the air to get out; but last Tuesday night the illuminating power was 14·90 candles, so that they had really got over the difficulty. There had been a long discussion among the directors as to when they would be able to reduce the price of gas another 10 per cent. They found they could not with safety to the dividend reduce the price at present; but after getting the Redheugh works into full operation, they hoped by this time next year, or before it, to be prepared to reduce the price from 3s. to 2s. 9d. per 1000 feet, with 10 per cent. discount, which

would bring it rather below 2s. 6d. per 1000 feet. They would have liked to have made the reduction this year, but it could not be done with safety. He moved the adoption of the report and the declaration of dividend as recommended.

Mr. WILLIAM BROWN seconded the motion, which was agreed to.

On the motion of the CHAIRMAN, seconded by Alderman PLUMMER, the directors were authorized to borrow £25,000.

On the motion of the CHAIRMAN, seconded by Alderman GREGSON, it was unanimously resolved to increase the salary of the secretary from £500 to £600 per annum.

The retiring directors and auditors were re-elected.

Mr. J. B. ALEXANDER moved a vote of thanks to the chairman, and said they all sympathized with him very much in the great loss he had suffered, and the inconvenience he had been put to by being burnt out of his home.

Mr. STUART seconded the motion, which was agreed to.

The CHAIRMAN returned thanks, and the meeting concluded.

LEWES GAS COMPANY.

The Annual Meeting of Shareholders was held on the 20th inst.—Mr. E. MORRIS in the chair.

The following report was submitted:—

The directors have much pleasure in submitting their annual report, and they congratulate the shareholders upon the satisfactory result of the transactions of the past year. The balance of £2755 11s. 5d., as shown by the statement on the other side, is the profit for the year, and there is a balance of dividend account amounting to £620 18s. 6d.

The directors advise that £2025 10s. be divided among the shareholders, being a dividend at the rate of £10 per cent. per annum (3 per cent. having been already paid on account thereof); that £600 be added to the reserve, and that £130 1s. 5d. be retained on the dividend account.

In accordance with the resolution of the special meeting, held Aug. 14, 1876, 606 B shares and 51 new B shares of £5 each (representing £3285) have been issued and taken up by the shareholders.

The loans amounting to £5000 have been paid off.

The directors have commenced the alterations and improvements referred to in their last report, and believe, when completed, they will be advantageous to the company as well as beneficial to the consumers.

It will be necessary to obtain additional capital to pay the costs of the alterations now in hand. The directors are of opinion the company will be placed on a still firmer basis if the amount of capital be sufficiently increased to permit an investment of (at least) £3000 in Consols as a permanent reserve-fund, and they recommend a further issue of new B shares for the above purposes.

The directors have also considered the future prospects of the company, and submit that the time has now arrived when the shareholders should obtain an Act of Parliament.

The directors sincerely regret the loss by death of their friends and colleagues, Messrs. Henry Browne and William Farnes, the former having for many years acted as chairman of the board, and, by his able management, contributed much to the present prosperity, and the latter having for many years given assiduous attention to the interests of the company.

The directors have pleasure in recording their approbation of the efficient services of the manager, Mr. John Hammond.

There have been fourteen meetings of the directors since their election, of which Messrs. E. Morris, J. L. Parsons, and C. Parsons have attended all; Mr. John Bates, thirteen; Mr. James Broad, twelve; Mr. R. Crosskey, ten; Mr. C. R. Kemp, seven; and the late Mr. W. Farnes, one.

Dr. *Revenue Account for the Year ending June 24, 1877.* *Cr.*

Expenditure.				*Receipts.*			
Coals	£2637	7	3	Public and private lamps	£631	17	0
Salaries	605	10	0	Gas consumers by meter	5154	9	2
Wages	388	2	1	Coke	934	3	3
Lime	51	15	0	Ashes	22	6	6
Repairs	483	2	0	Tar	348	3	5
Public lights	123	10	5	Sulphate of ammonia	318	14	10
Rates and taxes	190	17	3	Rent of wharf	5	0	0
Incidental expenses	98	9	9				
Interest	69	17	10				
Insolvent account	10	11	2				
Balance	2755	11	5				
	£7414	14	2		£7414	14	2

Balance-Sheet.

Shareholders capital	£20,255	0	0	Plant	£17,199	0	8
Debts	117	10	5	Buildings	2,218	18	5
Amount due to manager	0	2	0	Land	1,700	19	0
Insolvent account	20	0	0	Stock-in-trade	1,181	2	11
Unclaimed dividends	45	6	0	Debts	1,939	6	3
The reserve	2,400	0	0	Cash at bankers	1,298	17	10
Amount retained on dividend account	620	18	6	Ditto dividend account	45	6	0
				Ditto in hands of clerk	23	4	3
Balance of revenue account	2,755	11	5	*Ad interim* dividend	607	13	0
	£26,214	8	4		£26,214	8	4

The CHAIRMAN moved the adoption of the report, and congratulated the shareholders on the success they had met with in their transactions during the past year and the satisfactory report which had been presented to them. The report contained some very important proposals, which would require the full consideration of the shareholders. The directors would look into and carefully consider any suggestions which might be made by any of the shareholders present.

Mr. LENNY took exception to that part of the report recommending a further issue of B shares. He considered that to invest £3000 in Consols, for a reserve-fund, would be a misappropriation of their money and a wild and monstrous scheme. He hoped the shareholders would not assent to it. He taxed the directors with sheer extravagance in expending some £200 or £300, when all that was required might easily have been done for £15 or £16 a year, by insuring the property.

The CHAIRMAN remarked that they could not insure themselves.

Mr. LENNY said he was surprised at that statement. He could name instances in which it had been done. At Eastbourne the company's property was insured.

Mr. GODLEE contended that the chairman was perfectly right. He denied the assertion that they could insure anything they liked. The report met with his entire approval.

Mr. WRIGHT wished to give his unqualified support to the directors, and thought the report was all that business and practical men could desire. He wished to express his approbation of the valuable services rendered by Mr. Hammond, the manager.

Mr. LENNY moved that the report be not adopted.

Mr. GREEN seconded, and concurred with Mr. Lenny in his remarks.

The amendment, on being put to the meeting, was lost, only the mover and seconder holding up their hands in its favour. The original motion was then carried by a large majority.

The dividend recommended in the report was declared, and the retiring directors re-elected, and the remuneration of the Board was increased from £100 to £150. The auditors also were reappointed, their remuneration being fixed at ten guineas.

Votes of thanks to the directors and to the chairman closed the proceedings.

EPWORTH GAS COMPANY, LIMITED.—At the annual meeting just held, a dividend of 7 per cent. was declared, and, as stated in our last, a reduction of 5d. per 1000 feet was made in the price of gas.

PETERBOROUGH GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held on the 14th inst.—Mr. W. HARRIS in the chair.

The following report was presented:—

The directors herewith submit to the shareholders the balance-sheet and statement of accounts for the half year ending June 30, 1877, and have much pleasure in presenting to them results equally satisfactory with those of the two preceding half years.

Although the revenue from the sale of gas is not in excess of that in the corresponding half year of 1876, owing to the difference in the price, yet the cost of manufacture has been less, and consequently an increased profit has been made, the balance of the revenue account being £2410 2s. 6d.

The balance of the profit and loss account, including £530 17s. 2d. brought forward from last half year's account is £2940 19s. 8d.; out of this sum, and after providing for the payment of the preferential dividend on the £5 per cent. new preference A shares, the directors recommend the payment of the maximum dividend for the half year on the remaining share capital of the company, and a back dividend at the rate of £2 per cent. per annum, or 4s. per share, on the ordinary shares of the company for the year ending Sept. 30, 1869, free from income-tax, payable on and after the 21st day of August inst., and that out of the balance then remaining, amounting to £580 14s. 8d., your directors further recommend that £350 be placed to the credit of the reserve-fund, and £50 to the credit of the contingent-fund, leaving a balance of £180 14s. 8d. to be carried forward to the next half year's account.

Having entered into fresh contracts for the supply of coal on very favourable terms, your directors are enabled to recommend a further reduction of 2d. per 1000 feet in the price of gas, thus returning to the price charged before the coal famine ensued. This reduction is equal to about £350, and the abatement will be made from the 1st inst.

Your directors having had their attention drawn to the increase of duty falling upon the secretary, feel themselves justified in recommending that his salary be increased £25 per annum.

Your directors also desire to express their entire satisfaction with the manner in which the manager (Mr. G. Ernest Stevenson) has discharged the duties of his office. The result of the half year's working is the best testimony of his worth.

The CHAIRMAN proposed the adoption of the report, and stated that he thought they might be very well satisfied with the results of the past half year. If they had had a winter of ordinary severity, the consumption would have been much larger, but not being able to control the seasons they had to turn them to the best account. The report and balance-sheet would repay a careful perusal; for the financial statement was of great interest to several hundreds of people, mostly resident in Peterborough, who would be more or less glad at the prosperity of the company, according to the amount they had at stake in it. In the month of July, by a trick of the stock-jobbers, gas shares generally suffered a depreciation in value. £130,000,000 was invested in gas undertakings in the country, and in consequence many shareholders became alarmed, and the electric light darkened their understandings for a time. The electric light had been employed for many years, and the most recent improvements in it had been made by a Russian. This improvement had been tried in London and Paris, and, however gratifying these results might have been to the inventor, they were not such as to cause the slightest anxiety to gas shareholders. Scientific men employed by the London and Paris Gas Companies, had been employed in making out the cost of the electric light, and it was found to be four times as much as the cost of gas. But if there was not this objection of expense, there was another scarcely less fatal to it, and that was that it cast a deathly pallor over the faces of persons. In any place of amusement where the light employed made the ladies faces look like the faces of corpses, that light would not long be popular. It was possible that at some remote future, gas might be superseded, but the means had yet to be discovered, and he ventured to think that the youngest in their company would be amongst the ancients before that time.

Mr. E. VERGETTE seconded the motion, which, after some remarks by Mr. GOSNOLD, was carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. HOLDICH, the dividends recommended in the report were declared.

The recommendation of the directors in respect to the remuneration of the secretary was also agreed to, and the retiring members of the board—Mr. Harris and Mr. Holdich—were re-elected. Mr. Buckle was elected auditor in the place of Mr. Smith.

The proceedings terminated with a vote of thanks to the chairman.

WAKEFIELD GAS COMPANY.

A Meeting of the Shareholders of this Company was held on the 13th inst.—Mr. W. STATTER in the chair.

The CHAIRMAN said that since their last meeting the company's Act, giving them increased powers, had received the Royal Assent. There were several petitions against it, including one from the Wakefield Corporation, another from the Governors of the charities, and another from Lady Cardigan. The corporation withdrew their petition on the illuminating power of the gas being increased from 12 to 15 candles, and the Governors and Lady Cardigan also withdrew on the company undertaking only to store gas, and not to make it, in Ings Road. The Government had compelled them to insert a clause to the effect that new shares should be offered by auction or by public tender, and they had also been required to form an insurance and reserve-fund out of the proceeds of the undertaking. The chairman further remarked that during the half year they had made 67,240,000 feet of gas against 64,915,000 feet in the corresponding half of last year, which, remembering the bad trade, the directors considered very satisfactory. The illuminating power had been maintained at above the average figures. The leakage had been greater than usual, being 19·2 against 18 per cent. This was mainly caused by nearly a thousand public lamps burning 4 feet of gas per hour, although the corporation paid for only 3 feet. The directors had winked at this for a considerable time, but at length they had given the corporation notice that in future they would have to pay for what gas they used, and that the company would not continue to make them a present of one-fourth of the consumption. The chairman having made some further observations with regard to the affairs of the company, proposed the adoption of the accounts.

Mr. HALDANE seconded the motion, which was put and carried unanimously.

The CHAIRMAN then proposed that the usual dividends of 10 per cent. and 7½ per cent., free of income-tax, be paid on the old and new shares. In doing so, he stated that the income had been considerably larger, and the expenditure much less than in the corresponding half of last year. He also stated that the company were in a position to pay 7s. 6d. towards 10s. which was due for arrears of dividend.

Mr. W. BRIGGS seconded the motion, which was carried, and Dr. Wood and Messrs. W. Stewart and G. Haigh, retiring directors, were re-elected.

On a motion (not seconded) to increase the remuneration of the directors from £20 to £50 each per annum,

The CHAIRMAN informed the meeting that the remuneration had remained at £20 since 1847, and that since then the income of the company had increased from £4600 to £24,000. The directors therefore thought that £20 per annum was now a mere acknowledgment and pittance.

Mr. Sidney was re-elected one of the auditors, and the remuneration of the two auditors was increased from £8 8s. to £12 12s. per annum each.

The meeting was then made special, when it was resolved to increase the capital of the company by £25,000, by the issue of new shares to that amount.

The proceedings closed with a vote of thanks to the directors,

ALDERSHOT GAS AND WATER COMPANY.

The Ordinary Half-Yearly Meeting of Shareholders was held on Wednesday last, the 22nd inst.

The report of the directors was as follows:—

"The annexed accounts of the third year's working under the deed of management, show a profit of £2066 1s. 9d. from which has been paid the interest on all the preference charges, and a dividend on the ordinary shares for the first half year of 2½ per cent., leaving a balance remaining of £985 14s. 7d., from which the directors recommend that a further dividend for the last half year of 3 per cent. should now be declared, making a dividend for the whole year of 5½ per cent. (free of income-tax), and leaving a balance of £252 10s. 7d. to be carried forward as undivided profit to the next year.

"*Gas-Works.*—The sale of gas is still increasing, and the new gasholder has been in use during the last six months without any complaint. The total cost of the new works during the year has been £2821 15s. 4d.

"*Water-Works.*—There has been an outlay of £85 10s. 7d. for new mains, but the demand for water is not so large as expected.

"The whole of the 2500 ordinary shares of £10 each have now been paid up in full, and the only capital authorized by the Act of Parliament unissued is £585 of 5 per cent. preference stock."

Dr. *Revenue Account for the Year ending June 30, 1877.* *Cr.*

Messrs. Wilson & Douglas for the supply of gas and water, and the collection of rentals as per contract	£3818	2	4	Sale of gas	£4869	15	2
Insurance, rates, and taxes	61	18	5	Rent of gas-meters	183	5	5
Direction and audit	110	10	0	Sale of water	1038	19	9
Rent of offices	88	17	8	Rent of water-meters	35	0	6
Sundry charges	101	10	8	Rents of cottages and offices	150	0	0
Suspense account (written off)	50	0	0				
Balance (profit)	2066	1	9				
	£6297	0	10		£6297	0	10

COLNE VALLEY WATER COMPANY.

The Seventh Ordinary Meeting of Shareholders was held at the Charing Cross Hotel, on Friday last—the Viscount MALDEN in the chair.

The SECRETARY (Mr. P. Verini) read the notice convening the meeting, and the following report and statements of account were presented:—

The board having to submit the financial statement of the company at the close of the first period during which water has been supplied and revenue earned, have instructed Messrs. C. F. Kemp, Ford, and Co., the public accountants, to examine the accounts from the formation of the company to the 30th of June last, to make the necessary adjustments between capital and revenue, and to prepare therefrom a balance-sheet and revenue account, which are annexed, duly signed by the company's auditors.

The progress of the company has been most satisfactory, and the directors trust that the balance-sheet and revenue account will be considered by the shareholders as extremely favourable.

The water-rates receivable from that portion of the district at present supplied amount to nearly £1100 per annum.

The Registrar-General's monthly return continues to show that the quality of the water of the Colne Valley Company is superior to any supplied by the companies in the inner or outer London circle.

Dr. *Balance-Sheet, June 30, 1877.* *Cr.*

Capital—				Works construction, purchase of land, parliamentary, and incidental expenses prior to opening	£96,616	10	3
10,000 shares at £10 each	£100,000	0	0	Pumping-engines	8,287	6	10
Less unpaid	381	0	0	Plant and machinery	519	0	8
	£99,619	0	0	Cottage on reservoir ground	482	4	7
Debentures	11,965	0	0	Office furniture and fittings	93	14	1
Sundry creditors	2,960	10	7	Stores on hand	814	1	0
				House stores	461	2	2
				Plumbing plant and tools	74	18	9
				Debtors—			
				For water-rates	378	4	6
				,, Fittings & connexions	355	15	8
				Sundries	19	14	10
				Cash—			
				On deposit	5,500	0	0
				At bank	622	14	9
				Petty cash	30	6	2
				Revenue account, balance	288	16	4
	£114,544	10	7		£114,544	10	7

Revenue Account.

Office expenses, rent, taxes, stationery, &c.	£217	10	2	Water-rates from Aug. 1, 1876, to June 24, 1877	£696	3	7
Wages	232	16	8	Ditto building supplies	17	11	5
Salaries	301	10	0	Meter-rents	20	1	1
Insurance	33	0	9	Sale of chalk deposit	4	5	0
Commission to collector	8	12	9	Plumbing account	204	7	0
Stable expenses, &c.	43	13	8	Transfer fees	2	2	6
Engine working expenses £138 16 7				Balance	23	9	2
Less stores on hand 33 4 1							
	105	12	6				
General working expenses	28	3	3				
	£970	19	9		£970	19	9
Balance	26	9	2				
Interest on loans £47 2 5							
Less interest on deposits 15 9 10							
	31	12	7				
Interest on calls paid in advance	230	14	7				
	£288	16	4				

The CHAIRMAN, in moving the adoption of the report and accounts, said he had very few remarks to make. He thought the directors were perfectly justified in congratulating the shareholders upon the progress which the company had made during the past year. It was well known that as a rule, water companies were a long time from the date of their establishment before they began to pay anything like good dividends, but, although he did not suppose that the Colne Valley Company would prove to be any remarkable exception, he could not help remarking that they had already made much greater progress in the development of their business than could possibly have been anticipated when the works were first started. It must be remembered that it was only a year ago that the works had been entirely opened, and yet, as the accounts showed, they had made money enough to cover the expenses incurred during that period. In fact, every one who had seen the works—engineers and others who had taken pains to examine them—were perfectly astonished at the rapid development of the whole undertaking. The number of houses now supplied with water by the company was over 600, and they were daily receiving fresh applications from all quarters, not only from the possessors of large houses and large building firms, who were erecting mansions in various parts of the district, but also from the owners of small tenements around, which the directors regarded as a very good and hopeful sign indeed. Of course, there had been some drawbacks and difficulties to contend with—no company were without them; but he hoped they had, to a large extent, overcome them. One of their difficulties had arisen from the bursting of pipes, but these had been rapidly restored. It was fortunate, perhaps, that these casualties had happened while there were workmen on the spot ready to repair the injuries, and he hoped that now, after the experience of the high pressure to which they were subjected, they might be regarded as in a satisfactory condition for the future requirements of the company. The shareholders were aware that there had been some negotiations between the company and the authorities at Watford in reference to the supply of water to that town in bulk. The negotiations, indeed, went so far that the company had offered a price per 1000 gallons for the proposed supply, but it appeared that some very influential members of the Watford Local Board objected strongly to the purity and softness of the company's water, and their influence carried the day, and the whole matter fell to the ground. The construction of the necessary works for that supply would have put the company to considerable expense, and the directors thought it better to lay out that money in coming Londonwards, where their water would be much better appreciated than on the other side of the Colne. There was one matter in reference to which he had to express regret, and that was the costs to which the company had been put, in connexion with a lawsuit between them and the Edgware Highway Board. It appeared that, soon after the company began working within the district over which the Edgware Highway Board had control, they called upon the company to supply plans not only of the manner in which they intended to lay down their pipes, but also of the actual route they would pursue. The company were perfectly ready to supply the board with the former, but it was impossible to give the exact route, because they could not tell from day to day what obstructions the engineers might meet with, necessitating deviations which could not be anticipated. However, the board insisted upon their rights, and the company, taking the best opinion they could get on the subject, were led to suppose that under their Act of Parliament they were justified in opposing the board. The decision of the Court was against them, and though they were advised that there was good ground for appealing against that decision, the directors felt that, as representing a young company, it would be better to let the matter rest where it was, and come to some amicable arrangement with the Edgware Board respecting future operations. He did not know that there was any other point to which he need refer, and would therefore conclude by expressing a hope that the shareholders would be satisfied with the progress hitherto attained, and with the prospects of future success, which the directors firmly believed were before the company. He might, however, add that the £381 which appeared in the balance-sheet as an amount unpaid on account of shares, had, since the accounts were prepared, been paid up, so that the £100,000 of capital was complete.

General Sir E. W. F. WALKER (vice-chairman) seconded the motion.

Mr. J. F. BATEMAN, C.E., one of the directors, in answer to inquiries by a shareholder, explained that the bursting of a few pipes in the outset of a water undertaking was not an unusual mishap, and there had been fewer in the case of this company than in many others that he had had to do with. Speaking of the progress and prospects of the company generally, he expressed an opinion that they were exceptionally favourable. It was not often, he said, that a water company were in a position, within twelve months of commencing operations, to meet all their current expenses. The £713 which appeared in the revenue account was the rental for the year beginning with nothing, and, therefore, must not be taken as the present rental of the company—which, indeed, was about £1100, while the expenses were not quite £1000. Having created an income of £1100 in the first year, he thought they might anticipate with considerable confidence and satisfaction the making of nearly another £1100 in the second year. They had, in the first instance, to feel their way; it was necessary to inspire people with confidence in the power of the company to give a supply, and also in the character of the water. The water was now declared to be superior to that of any other water near the Metropolis, and was admitted by those who used it to be extremely beneficial to their health. For himself, he looked forward with sanguine expectation that, when the real advantage of this water was more fully appreciated, there would be a large amount of building carried on in the district within the area of the company's supply. He had the greatest confidence in the future prosperity of the undertaking, and he thought himself justified in saying that the past management of the company's affairs reflected the highest credit on the directors and their secretary.

The motion was put and carried unanimously.

General Sir E. W. F. WALKER moved, and Mr. NOAKES seconded, a motion continuing the remuneration of the secretary at the same amount voted last year, which was agreed to.

The remuneration of the auditors was, on the motion of Mr. HOLLAND, seconded by Mr. BATEMAN, also fixed.

A vote of thanks to the chairman closed the proceedings.

CARLISLE CORPORATION GAS SUPPLY.

At the Meeting of the Carlisle Town Council, on Tuesday, the 14th inst.—the MAYOR (Mr. S. J. Binning) presiding,

A minute was brought up from the Gas Committee, recommending that the price of gas be reduced 3d. per 1000 cubic feet from the 1st of July last, and that in addition to the £200 per annum now paid, a further sum of £800—making a total of £1000—be paid to the city fund from the profits of the gas-works during the current year, to be appropriated as the council may determine.

Mr. BEWLEY, in moving the confirmation of the minutes, said that, although the audit of the accounts was not quite completed, it was sufficiently advanced to show that the profits were quite equal to those of the year before, and amounted to £5400 or £5500. With respect to the disposal of this large profit, the committee considered the matter from two points of view, namely, not only to make a reduction of 3d. per 1000 feet upon the gas, but also to give £800 for the use of the town for extension and improvement. That with the £200 annually given would make £1000 for this year. He believed that the reduction of 3d. per 1000 would amount to £1400 or £1500, and that with £1000—which they intended to give annually if they possibly could, though they could not guarantee it—would make £2500 a year, which would leave a sum of about £3000 still in the hands of the committee. That they would use for small extensions and improvements, and they considered that where large extensions in the works were intended they should alter the system that had been adopted and carried out ever since the corporation became possessed of the works, and instead of giving the whole of the profits to that purpose they would borrow money, payable in 30 years or something like that, so that they might charge posterity for part of the improvements from time to time carried out at the gas-works. The works were now of very large value, being worth about £60,000, and he was very glad to inform them that there was a sum of £10,000 lent, so that the works were now clear to them.

Mr. FORSTER seconded the motion.

Mr. BEWLEY, in answer to an inquiry, said the Gas Committee had given attention to the improvement of the quality of the gas. Mr. Hepworth, the manager of the works, had fully explained that the mains had been so very much interfered with all over the town that the case was exceptional. Atmospheric air had got into the pipes, and some of the present mains were entirely cut off, and the supply had been passing through other pipes than those through which it usually passed. Mr. Hepworth, during a conversation about increasing the illuminating power of the gas, said that he could make gas at 2s. 9d. per 1000 feet, that, not only with regard to cleanliness, but brilliance, would satisfy the most fastidious person in Carlisle. The committee asked him whether it would be better to lower the price of gas, or increase the price and give better quality, and he said he could give as good quality as need be desired at 2s. 9d. per 1000 feet, so soon as the improvements were made and the pipes all laid. With respect to the future profits, the price of coals being very similar to what it was in the preceding year, there was no reason whatever for supposing that the profits this year would not be as great as in the last two years.

Mr. HEPWORTH explained the difficulties under which the supply of gas had been maintained during the last twelve months, and said the Gas Committee really would need the forbearance of the public. They were supplying a large district north of the "Bush" Hotel, including three newspaper offices, through the main that was intended only to serve Stanwix, and was only a small one for that purpose. The committee must wait until the viaduct was completed before resuming the supply to that part of the town. The wonder to him had been, not that they had the gas in uncertain quantity and of poor quality, but that they had it at all. They were constantly breaking the mains, but in a short time they would get rid of that, and when that was done, there could not, he thought, be any reasonable grounds of complaint about the quantity. In answer to an inquiry, he said that the admission of atmospheric air reduced the illuminating power of the gas. One per cent. of air would cause a loss of light equalling 6 per cent.; 5 per cent. of air would cause 33 per cent. loss of light; 10 per cent. of air would reduce illumination by 67 per cent.; and with 40 per cent. of air there would be no light at all. He had noticed some remarks about balloons, which displayed perhaps not ignorance, but an absence of knowledge. The aëronaut of the balloon that recently ascended at Carlisle wrote to him asking what was the specific gravity of the gas here, and he answered him that it was ·490. Now the specific gravity of the gas increased with its illuminating power. Gas with an illuminating power of 10 sperm candles was ·380 specific gravity; of 12 sperm candles, ·405; 14 candles, ·430; 16 candles, ·455; 18 candles, ·482; 19 candles, ·495. The illuminating power of Carlisle gas ranged from 18 to 19 candles. They would see from the figures the richer the gas the greater was its specific gravity, and, therefore, the less was its capability of floating a balloon. If they wanted gas to float a balloon they must go to Workington, where they did not use cannel gas, and did not make such rich gas.

The MAYOR said the Gas Committee had come to a very wise conclusion in presenting the town with £1000, and he hoped they would be able to carry it out regularly.

The minutes were then confirmed, and the money was ordered to be paid over to a separate account, until it was determined what should be done with it.

WIGAN GAS-WORKS EXTENSION.

LOCAL GOVERNMENT BOARD INQUIRY.

In the month of March last the Corporation of Wigan applied to the Local Government Board for sanction to borrow £25,000 for the extension and improvement of the gas-works, and in accordance with the directions of the board, Mr. S. J. Smith, C.E., one of their inspectors, held an inquiry at Wigan on the 10th inst., on the subject matter of such application. At the opening of the proceedings—

The TOWN-CLERK (Mr. Peace) read the notice convening the meeting, with the certificate of the posting of the same, also the memorial of the Town Council to the Local Government Board with regard to the borrowing of the money.

The INSPECTOR said he attended to receive, and was now prepared to receive the evidence of the promoters, and, if any, the evidence of the opposition.

The first witness called was—

Alderman *Hopwood*, who was examined by the TOWN-CLERK. He said: I I am chairman of the Gas Committee of the Corporation, and have been chairman since the works were taken over by the town. I find that the capacity of the works, as at present constituted, is totally inadequate to meet the requirements of the district of the gas supply. The committee, since the works were obtained by them, having laid the large new mains into the district as proposed at the last inquiry, and sanctioned by the Local Government Board, these new mains have proved of great value, and were laid of sufficient size to meet the requirements of the district of the gas supply for several years to come. No sooner, however, were the new mains laid than it was found that the producing power of the works was quite inadequate. The size of the present gasholders is such that they are only capable of storing about three hours supply in the depth of winter. The maximum quantity of gas distributed and consumed in one day in winter in the town and district is 1,250,000 cubic feet of gas, and the joint capacity of the two present holders is only 495,000 feet, or about a third of one day's supply. The general rule of gas-works is to have storeage room for not less than a day and a half, and this is considered more imperative in a manufacturing district like Wigan, where the bulk of the consumption takes place during the first three hours of the night. To meet the present and future demands the Gas Committee purpose to carry out the following extensions and improvements in the gas-works:—One telescopic holder, 150 feet diameter, in two lifts of 30 feet each, with brick tank for the same 155 feet diameter, and all necessary connexions, valves, &c.

The INSPECTOR said these details had better be given by the gas manager.

Witness: I may state that I have gone through the estimates which will be spoken to by the engineer. The Gas Committee instructed Mr. Hawkins to prepare plans and specifications for alterations at the gas-works to increase the productive power of the works, and also to increase the capacity of the holders, and in accordance with those instructions he prepared an estimate which was laid before the committee and sanctioned by the council.

The TOWN-CLERK said that since the memorial had been forwarded to the Local Government Board the corporation had succeeded in obtaining the permission of the Lancashire and Yorkshire Railway Company to construct a siding from their railway into the works of the corporation. At present coal and all kinds of material going to the works had to be carted from the railway, and so had the coke and tar which were produced at the works, which, of course, entailed an enormous cost upon the corporation.

The INSPECTOR: I see that your estimate exceeds the £25,000 by about £3000. Before you can get that extra money you will have to produce to the Local Government Board a resolution of the Town Council sanctioning the borrowing of the other money required.

The TOWN-CLERK: Yes, certainly; but when here we thought you might satisfy yourself as to the desirableness of spending money in the construction of a railway siding from the Lancashire and Yorkshire Railway to the gas-works.

Mr. *J. G. Hawkins* said: I am the gas manager for the Wigan Corporation, and have been so for a year and a half. It was under my superintendence that all the recent alterations have been conducted. Under instructions from the Gas Committee I prepared plans and estimates of the necessary alterations, and these have been submitted to the Local Government Board. I believe the first requirement is a new holder, and that is described as one telescopic holder 150 feet diameter in two lifts of 30 feet each, with brick tank for same 155 feet diameter, 31 feet deep, and all necessary connexions, valves, &c. The estimate for this is £17,550, including the necessary excavations. There are two additional purifiers 20 feet by 20 feet by 4 feet 6 inches deep, with valves and connexions. The estimate for that is £680. Two boilers have also been procured, and they are 20 feet long by 6 feet 6 inches diameter, double flued. The old boilers are worn out and too small. The estimated cost is £600, and for the boiler-house and chimney £250. There are two scrubbers 70 feet high, 12 feet diameter, with spiral staircase, and their estimated cost is £2500. There is one set of annular condensers of 24 pipes, 30 feet high, by 2 feet 8 inches diameter, £1600, and one coalshed 89 feet long by 50 feet wide, constructed of brick with stone trimmings, £1017. Since the memorial was sent in to the Local Government Board the Gas Committee have come to terms with the Lancashire and Yorkshire Railway Company for communication with their line by means of a direct siding from their railway into land belonging to the corporation at the gas-works. [Witness read the letter.] The great advantage of the proposed siding, as shown on the plan, is that it will run direct from the land of the railway company on to the land belonging to the corporation, so that there will be no other landowner to deal with. We have applied to the railway company for an estimate of the cost of the siding, but have not received it.

The INSPECTOR: What is the cost of haulage now?

Witness: We estimate that it costs about £3500 per annum to bring the coal and cannel to, and to take coke and residual products away from the works, so that when we get a siding it will save £3500, less tollage and the interest of the money. The storeage capacity of the present holders and the new holders when complete will be 1,500,000 cubic feet, which is about equal to a day and a quarter's consumption. Although that is not quite up to a day and a half's consumption, the committee hope it will be sufficient. There has been an increase in the consumption of gas during the past year, notwithstanding the disadvantages under which the Gas Committee have laboured, of a little over 20 per cent., and, considering the number of new buildings and works which are rapidly springing up in the town and the out-districts, it is believed that this increase will continue for some time to come, and the committee are most anxious to be in a position to meet it. The number of houses and works built in the town alone during the past year is 538, and the number of houses built in the out-townships during the past year is believed to be considerably more. During the past year, the Pemberton Local Board have lighted their streets with public lamps. New streets have also been opened out in that district, and the local board have served the committee with notices to lay mains and erect public lamps throughout their entire district. The Aspull Local Board have also given notice to light the whole of their streets with public lamps, which are being proceeded with. Upwards of 70 additional public lamps are also being erected within the borough, rendered necessary by the formation of new streets and the erection of new property therein. The consumption of coal and cannel at the works amounts to 25,000 tons per annum, and 10 per cent. of that amount is cannel. I believe power is given the corporation by the Wigan Improvement Act, 1874, to borrow £140,000, and with the consent of the Local Government Board an additional £50,000. The corporation have borrowed £140,000, and £10,000 of the £50,000, for which they have received the sanction of the Local Government Board. They are now seeking the sanction of the Board for further borrowing powers to the amount of £25,000, which leaves a balance of £15,000 still to be borrowed for the purposes of the Wigan Improvement Act.

Mr. *Betley*, borough analyst, said his duties in connexion with the town council frequently took him to the gas-works, and he had seen the great exertions made by the manager night and day to keep up the supply, both as regarded the inadequate productive power and the deficient storeage capacity. On one of these occasions the manager had to watch the descending holder at eleven o'clock, when the public-houses were about to close, and when it was within an inch of the bottom. The illuminating power of the gas is 18 candles, and he believed Mr. Hawkins proposed to put up additional purifiers to remove the carbonic acid. The gas was always free from sulphuretted hydrogen.

There being no other evidence,

The INSPECTOR declared the inquiry closed, and said he should report the result in due course to the Local Government Board.

An inspection of the gas-works was subsequently made by the Inspector and several members of the Gas Committee.

The Gas-Works Visiting Committee, at their meeting on the 15th inst., resolved that it be recommended to the council to obtain the sanction of the Local Government Board to increase the borrowing powers under the Wigan Improvement Act, 1874, relating to gas, by £15,000 beyond the £25,000 applied for.

NEWRY GAS CONSUMERS COMPANY.—At the annual meeting of the directors and shareholders, held at the works, on the 17th inst., Mr. H. W. Wallace in the chair, a dividend of 10s. per share on the paid-up capital of the company, and 8s. each on the extension shares, was declared. The works were reported to be in an efficient state, and a hope was held out of a reduction in the price of gas.

STREET LIGHTING AT WINCHESTER.—Come we here to another change. In the supplement to the last edition of "Milner's Winchester," it is stated: "In the year 1832 a gasometer was built, and the main-pipe laid down the High Street only, as a private speculation, to supply that part of the city with gas; an understanding having been entered into with the Pavement Commissioners for the supply of a certain number of public lights. Subsequently, the experiment having given general satisfaction, the inhabitants entered into a subscription to defray the expense of laying down branch pipes in the various streets of the city. The result of this display of public spirit was, that in the year 1834, the whole city participated in the comfort which had hitherto been confined to a small portion of it. The subscription was so liberal that, after all expenses had been defrayed, a surplus remained, which was expended in illuminating the large clock projecting from the front of the Guildhall of the city." This unappreciating generation in 1877 has for the second year discarded gas for the public lamps, actually seeking refuge in petroleum for lighting the streets. We have, however, observed with much satisfaction that the gas company are making some very successful experiments on three of the lamps in the City Road, and testing the improvements which Mr. Collins's newly invented and patented silvered glass reflectors give to the gas-lights. The company will, if they adopt the patent, be a formidable opposition to the oilmen at their next tendering time.—*Hampshire Independent.*

ACCIDENT TO A GASHOLDER-TANK AT MIDDLESBROUGH.

On several occasions during the last six months we have referred to an accident which occurred in February last to a gasholder-tank in connexion with the works of the Middlesbrough Corporation, and some further details respecting the cause of its collapse, and the proposed renovation of the work, will, no doubt, be of interest to our readers.

The tank was originally designed to be of the "composite" class—that is, a combination of concrete and brickwork, which was first adopted at the South Metropolitan works. According to the design, there was to be an inner lining of brickwork, bonded at intervals into the concrete backing, which should be filled in as the brickwork rises. The dimensions of the tank were as follows:—Diameter, 184 feet; depth, 30 feet.

The site is a plot of low-lying land which has evidently formed part of the estuary of the Tees, and consists of a deep bed of dark-coloured soft clay. This appears to have been deposited as river mud, and has not yet attained such a consistency as would warrant its being regarded as blue clay. In the course of making the excavation a serious slip took place on one side, causing the breakage of one of the town sewers and a water-main, which partially flooded the work, and further softened the soft clay.

The concrete wall alone, without the brickwork lining, was started without any footings, it being intended to add the lining after the concrete wall was finished, when the two could not be securely bonded together. The concrete was carried up, on this narrow base on the soft clay, to a height of some 10 or 12 feet of an uniform thickness, and at this height, in order to give increased strength, as was supposed, to resist the extra pressure of the earth caused by the slip referred to, the wall was thickened by adding to the back of it an additional 2 or 3 feet of concrete, until nearly two-thirds of the whole height was attained.

Excavation of the interior then began. The wall having been constructed in the usual manner in a ring trench or cutting, the earth was removed to form the cone, also to get in the footings in the front of the wall. When this excavation had proceeded more than half way round the tank, and had reached the part where the slip took place, the wall gvae way, breaking at this point from the part that was still supported by the interior, which had not been excavated, and coming forward into the tank, but retaining, to a great extent, its upright position, notwithstanding the fractures, which, in some parts, had completely detached large pieces pieces of concrete. Only about one-third of the circumference remains intact, the other two-thirds gradually curving inwards in the form of a rough spiral, until, at the point where the great fracture has taken place, the wall has been pushed some 10 or 12 feet towards the centre of the tank.

Mr. Cail, engineer, of Newcastle-on-Tyne, was in the first instance called upon by the Gas Committee to investigate the matter, and he made a report thereon, which appeared in the JOURNAL of March 27 (vol. xxix. pp. 464–5). Several plans were subsequently submitted to them, and it was ultimately resolved that the whole of them should be laid before Mr. George Livesey, of the South Metropolitan Gas-Works, with a request that he would examine the same, and report thereon to the council. He was also requested to state whether, in his opinion, the present site was suitable, or if it were desirable that another site should be substituted.

Mr. Livesey's report is as follows:—

"*London, May* 31, 1877.

"*The Chairman and Members of the Gas Committee of the Town Council of Middlesbrough.*

"Gentlemen,—In accordance with your request, I made a thorough examination of the damaged gasholder-tank on Friday, the 25th inst., and had the further advantage of a conference with you in the town hall, when the cause of failure was discussed, and the proposed plans for remedying the defect were laid before me.

"I was requested to give my opinion as to the cause of failure; next on the suitability of the site for the erection of gasholder-tanks; and, thirdly, supposing it to be determined to retain the site in the Marsh, what course I should recommend the committee to adopt in order to obtain a sound tank.

"1. As to the cause of failure.

"It is at least satisfactory to be able to state that I can find no fault whatever with the original design of your engineer—in all its main features it is exactly what I should have planned; and now, after the disaster has happened, if I were required to design a similar tank for erection, on an adjoining portion of the same site, I should make no important alteration in the original plan.

"The failure undoubtedly resulted from the faulty execution of the work. In the first place, if one may judge from the timber supports still in place, the original slip would not have taken place if proper care had been exercised in timbering the excavation.

"2. A grave mistake was made in starting the wall on so narrow a foundation. The plan provided for a bed of concrete 12 feet wide and 3 feet thick, on which the wall and the resting stones were to stand, and this solid bed should have formed the foundation on which to build the wall; but, instead of this, the contractor, most culpably and most unaccountably, began this heavy wall without any footings whatever, simply starting with the bare thickness of the concrete portion of the wall, on a foundation of soft clay, that required the broadest possible foundation, instead of the narrowest that could be devised.

"A further mistake was committed in omitting the lining of brickwork, which should form an essential portion of the wall, and be carried up with it, being bonded in at about every 2 feet in height. By being thus constructed, the brickwork serves a double purpose—it forms a true inner surface for the tank, which supports the concrete backing, and it adds strength to the wall. I was the first to introduce this plan in the construction of tanks for gasholders, and the chief reason for adopting the brickwork lining was to enable me to obtain a true inner surface, which, at the time, was considered difficult of accomplishment with concrete only. The brickwork lining should be 9 inches thick, and be carried up 18 inches, when the backing of concrete should be filled in to the same level; then a 14-inch course of brickwork should be laid and on that another 18 inches in height of 9-inch work, to be again filled in behind with concrete, and so on, thus producing one solid wall, instead of a wall of concrete, with a thin, unattached skin of brickwork.

"3. The additional thickness of the upper part of the wall, which rested on no solid foundation, tended to produce instability, by increasing the weight on the narrow foundation, and by throwing the centre of gravity dangerously near the back edge of the foundation.

"I should certainly have expected that at this stage the wall would have given way, but it seems that a further blunder had to be made; and, fourthly, we find that the contractor removed the clay from the foot of the wall, not in short lengths, as he should have done, of, say, 6 feet at a time, but for more than half way round the tank. It is perfectly marvellous how the wall stood so long; but, when the interior excavation was brought to the spot where the original slip took place, the support at the foot of the wall being removed, and the whole weight of the loose earth being exerted at that point, the inevitable result took place, and the arch once broken, the tank gave way, as we now see it.

"A consideration of the progressive steps that resulted in the disaster convinces me that, with proper care in carrying out the original design, there would have been no difficulty in bringing the work to a successful issue; therefore I have no hesitation whatever in saying that the site is suitable for the purpose for which it was selected, and that there is no reason for abandoning it.

"The third point raised last week was the best course now to be pursued.

"I consider that it would be quite possible to remove the present tank, and to construct one as originally designed; but I would not think of advising you to do so; the cost would be too great.

"I therefore suggest that a smaller tank should be built within the ruined one, removing only such portions of the broken wall as are in the way, and all the soft or disturbed clay. The broken wall must be made thoroughly secure by timber strutting, which a contractor who understands his business should have no great difficulty in doing; and, having ascertained how far the walls have come forward, the position of the new tank may be determined, and a bed of concrete, 4 feet thick and of sufficient width to receive the tank wall and resting-stones, should be carefully laid as the foundation, and on this the tank wall should be built, the thickness at the bottom not to exceed 4 feet of concrete and 9 inches of brickwork, or 4 feet 9 inches in all. If the work were mine, I should have only 3 feet 6 inches of concrete and 9 inches of brickwork, bonded with it on the plan previously described; the thickness at the top would be 1 foot 6 inches of concrete and 9 inches of brickwork, or 2 feet 3 inches in all.

"The slope of the cone may be 1 to 1, covered up the sides with about 12 inches, the top with 4 inches of concrete. If the present excavation renders it necessary to have a rather flatter slope, the difference will be of no consequence. The concrete covering must be laid on the undisturbed clay; no new clay or earth must be put in to equalize the irregularities; these must be filled with concrete.

"I am doubtful whether a thoroughly reliable contractor would give a definite tender for the construction of the work, except at a very high price, sufficient to cover all possible contingencies, most of which would, with proper care, almost certainly never happen. I do not think there would be much difficulty about it, but there would be a certain amount of risk attending the operation until the bed of concrete forming the foundation was got in all round; this would have to be put in in short lengths, and only so much of the bottom removed at one time as was necessary for this purpose. I should excavate a length of, say, 6 feet, and put in the concrete, then pass over 6 feet and make another excavation, and when some four or five lengths were done in this way, the intermediate lengths could be excavated and filled in.

"It ought to be possible to get a tank from 165 to 170 feet diameter, but I do not think the exact dimensions can be fixed until the bottom is examined. There would, however, be no difficulty in furnishing a contractor with plans and sections showing all that would be required in the finished tank, excepting only the exact diameter. The resting-stones would most likely be placed at the same level as in the original tank, or at most only about 1 foot higher, the same depth would, therefore, be obtained without increasing the height above the ground level.

"I send herewith a plan showing the tank I propose should be erected within the ruined one, and if built entirely within the existing walls, the diameter inside would be as nearly as possible 165 feet. I think, however, when the bottom is cleared it is very likely that it would be possible to make it a few feet larger, by reducing the thickness of concrete to about 2 feet on the side where the existing wall is sound, and by cutting away those projecting parts of the broken wall where it has come in farthest. It will not be necessary to set out the piers to carry the gasholder columns until the new wall overtops the old one, when the piers would be made to stand partly on the old wall. I have shown in my plan a regular diminution in the thickness of the concrete backing, but I need hardly say that this would not be followed exactly, for in those parts where the new wall comes in contact with the old wall I should maintain the contact right up to the top of the old wall. In those parts where the new wall is some distance from the old part, the conditions shown on the plan would be followed, only it would be necessary to make the filling in of the intermediate space as solid as possible, to the extent perhaps of building counterforts in concrete between the two walls.

"I have provided for no stone whatever, as being quite unnecessary, either for coping or base stones for the columns, or for resting-stones for the gasholder, or to carry the guides in the tank, as concrete answers perfectly for the three first-named purposes, and for the last jagged bolts let into the brickwork suit quite as well as Lewis bolts let in with lead into blocks of stone.

"The bottom of the foundation of the new tank is shown at one foot below the bottom of the foundation of the old one. I do this because I expect that it will be necessary to remove the earth or clay to this depth at least in order to reach a solid foundation. It is very likely that for a considerable distance the excavation must be carried to a greater depth, and if this should be the case, I should then place the foundation of the tank all round deeper than I have shown it.

"My plan shows a tank 30 feet deep, the same as your original one, the top of both being at the same level. I do not, however, advise you to adhere exactly to this depth, since you may, either by going a foot or two deeper with the foundation, or by adding something to the height, obtain a tank 35 feet deep, and this is the depth I recommend, as the extra cost will not be proportioned to the extra capacity, and moreover, with a diameter of 165 feet, 35 feet of depth would be better than 30 feet for the gasholder.

"The number of columns should not be less than 16 nor more than 20. I should have 18 columns and 36 resting-blocks for the gasholder—the centre pier is shown broken off, as I do not know whether a trussed or an untrussed gasholder will be erected; if the latter, the pier would be better if made about 8 feet in diameter, and to reduce the weight I should build it hollow above the ground.

"I have made an estimate of the cost of a tank such as described, but there is so much doubtful work to be done before the tank foundation can be laid, that any estimate must be, to a considerable extent, a matter only of opinion.

"I do not think, in the hands of a careful and competent contractor, and one who, if he undertakes the work, will not leave it until it is satisfactorily completed, the difficulties will be found to be great; but no sensible man would undertake it except at a price to cover all possible contingencies.

"If you could guarantee that the broken walls would retain the earth in its place, then such a tank as I have described ought not to cost more than about £4500 to £4800; but looking at the work that must be done in order to make the old walls secure before the new tank can be begun, I cannot put the cost at anything less than £6000, while it might very well run up to a higher figure. At the worst, however, I should say that it could not exceed £7000.

"It is absolutely essential that a thoroughly competent and reliable contractor be found, and with such a man, if the work were mine, I should employ him first to get the hole cleared and the 4-feet ring of concrete laid

in as the foundation; this work to be done on a schedule of prices, and the rest on a fixed contract by the same man.

"It would cost only another £400, or at the most £500, to add 5 feet to the depth, making it 35 feet, the thickness of the wall at the bottom and at the top being the same as shown for a 30-feet tank; if the additional depth were obtained by going deeper with the foundation, the cost would be considerably more—my estimate of £500 is based on the supposition that the top of the tank is made 5 feet higher.

"I shall be glad to supply any further information it may be in my power to give, should you require it.

(Signed) "GEORGE LIVESEY."

In June Mr. T. D. Ridley was requested to prepare estimates for carrying out the plans of Mr. Cail and Mr. Livesey for reconstructing the tank. The following is his report thereon:—

"*Contractor's Office, Middlesbrough, July* 6, 1877.
Gas-Tank.

"Sir,—In accordance with the request contained in your letters of the 20th and 29th ult., that I should give the Middlesbrough Corporation estimates of the cost of carrying out Mr. Cail's and Mr. Livesey's respective plans for reconstructing the gas-tank, I have gone carefully into the question. In dealing with the data on which to base the calculations, one very doubtful feature in the case immediately confronts us. This, the chief element of uncertainty, is the probability that the existing walls may not, when the water is pumped out, resist the pressure to which they will be subjected whilst the new foundations are being laid. To minimize this risk, and to keep these walls in position, a considerable expenditure must be incurred, and the most rigorous and watchful care must be exercised.

"For the purpose of ascertaining how the walls now stand, and to what extent they may be relied upon, I have examined them carefully, and have made measurements from the centre to the circumference all round, so as to find to what extent the periphery, in its present condition, differs from a true circle. I have also had the walls plumbed all round, in order to ascertain how much they are out of perpendicular, and where the greatest deviations from a plumb line appear. Although the walls are still perpendicular, or nearly so, at some points, yet generally they show indications of having been forced inwards at the bottom. The removal of the water now in the tank will still further increase the balance of outside pressure, and will have a tendency to cause still further yielding at the bottom of the walls. The contingencies arising out of these conditions have to be considered, and have been dealt with in the estimates I have prepared.

"I am not called upon to give any opinion as to the respective plans, nor do I wish to say a word as to their comparative merits, but shall only deal with questions affecting the estimates. In Mr. Livesey's plan the bottom of the foundation is shown to be a little lower than that of the existing wall, but my estimate provides for going only to the same depth, as it would be extremely hazardous to dig below the present wall foundation in such material as is found at the bottom of the tank. If the brick cylinders were excluded from Mr. Cail's plan, his walls would have as great a stability as Mr. Livesey's construction, but the cost would be slightly higher.

"In estimating the cost of reconstruction, I assume that the contractor to whom the work may be entrusted will enter upon it in its present condition, and that he will be put in possession of all the materials on the ground and adjacent thereto that have been provided for the contract. The estimate includes nothing for reinstating roads or buildings damaged by the subsidence of the ground, but only for the work required to construct the tank in accordance with the respective plans.

"With these explanations my estimates are:—

"1. For constructing the tank in accordance with Mr. Livesey's design, £9395.

"2. For constructing the tank according to Mr. Cail's design, with concrete walls resting on brick cylinders, £11,836.

(Signed) "THOMAS D. RIDLEY.

"George Bainbridge, Esq., Town-Clerk, Middlesbrough."

At the meeting of the town council on the 14th inst., it was resolved that Mr. Cail and Mr. Livesey be requested to prepare specifications for carrying out their plans.

LONDON WATER SUPPLY.

By Messrs. BRAMWELL and EASTON.

[A Paper read by Mr. Bramwell before the Section of Economic Science of the British Association, at Plymouth, Monday, Aug. 20.]

Probably some of the members present may know that we have (in conjunction with Sir Joseph Bazalgette), at the request of the Metropolitan Board of Works, recently reported upon the water supply to London, especially in relation to the quality of the potable water and to the provision of water at an adequate pressure for the extinction of fires. We make no apology for bringing the subject of the London water supply before this section, because that subject is an extremely large one, and the questions involved in its economic considerations are, therefore, of very considerable importance.

In 1874 the population supplied was 3,655,000, dwelling in 511,000 houses. The daily average quantity throughout the year was 116,250,000 gallons. The quantity per head, therefore, for all purposes, was a little under 32 gallons. As is well known, this water supply is in the hands of eight companies. The aggregate capital employed in 1874, including share and loan capital, was £11,196,000. The gross income from water was £1,137,000; in addition to this there was £16,000 from land rents—making a total of £1,153,000. The expenses were £447,500. The net income was £705,700, giving a rate of interest upon all the capital employed, share and loan together, of proximately 6·3 per cent.

In Major Bolton's last report, June, 1877, it is stated that the population supplied was 3,796,000, dwelling in 533,000 houses, and that the average daily quantity was 132,500,000 gallons, equal to a little less than 35 gallons per head during this summer month, and representing a probable average daily delivery throughout the year of from 120 millions to 125 million gallons. London, in common with other towns, requires water for the undermentioned purposes:—(*a*) drinking and culinary; (*b*) cleanliness—personal, domestic, and civil; (*c*) extinction of fires; (*d*) manufacturing; (*e*) road watering and miscellaneous.

With respect to the heads *b*, *d*, and *e*, we believe that the present water supply is generally satisfactory; but except in rare cases this cannot be said with respect of head *a*, nor in any case can it be said in respect of head *c*. The importance of these two heads it is difficult to exaggerate, as on the quality of the potable water depends, to a large extent, the health of a vast population, and on an adequate provision for the extinction of fire depends the preservation of the largest aggregation of wealth in the world. With respect to head *a*, we have already shown that there are in London close upon 4 millions of human beings who should be supplied with wholesome potable water; let us now see, as regards head *c*, what is the mere money value of the property requiring protection from fire.

This subject of fire extinction has frequently been the subject of parliamentary consideration—in 1862, in 1867, and again in 1876 and 1877. In these later years a committee, presided over by Sir H. Selwin-Ibbetson, has made the fullest investigation into the question of the Fire Brigade and into the means of extinguishing fire in the Metropolis. From the evidence given before that committee it appears that as much as £540,000,000 of London property is insured in the fire offices. With respect to the uninsured property there is a great diversity of opinion. No witness puts it lower than equal in amount to the property insured; so that no one gives the total value as being much less than £1,100,000,000. But other estimates made the proportion as much as one insured to four uninsured; the total value of the property, therefore, according to those estimates, amounts to £2,700,000,000. Captain Shaw's opinion, however, is, there is one-third insured and two-thirds uninsured. If he is right, then the total value of the property of London is a little over £1,600,000,000.

To revert to (*a*) potable water. One of the writers of this paper is old enough to remember the wheels at London Bridge pumping up the water of the Thames as it flowed past them, and delivering it direct into the houses of the inhabitants; and even within 30 years some of the companies took their supply from the Thames opposite what was then Hungerford Market, from the "Dolphin" at Chelsea, from Hammersmith, and from Kew; but year by year the river got more foul, and the population became more critical. Complaint was made as to the quality, and as the companies from time to time came to Parliament for further capital to meet the increasing wants, conditions were put upon them which have resulted in all the companies who derived their sources of supply from the Thames taking that supply from above Teddington Weir so as to be out of the tidal influence, and in the employment of depositing reservoirs and filter-beds so as to get rid, as far as possible, of all foreign matter.

But, in spite of all this, the public is not satisfied. Occasionally the water is declared on authority, by Major Bolton in his monthly reports, to be turbid, and in his last report (for June already quoted) Dr. Frankland says that the suspended matter in the water supplied by one of the companies was full of moving organisms. Naturally, the public, even after all that has been done, are not satisfied as regards the supply of potable water. Nor do we believe that they ever will be satisfied, or can be satisfied, so long as that water is derived from rivers into which is poured the sewage of a great part of the large population of the basins of the Thames and of the Lea, and also the surface drainage from the highly cultivated and therefore highly manured land of those basins.

With respect to (*c*) fire extinction, nothing at all has been done by the water companies beyond the giving of a supply of water at street levels, to be picked up by the pumps of the fire-engines and pumped upon the fire. Captain Shaw has said in his evidence before the late committee that his requirements, even at the largest fires (which requirements he calls very moderate), amount to no more than 2000 gallons of water per minute, capable of being played upon the fire through lengths of hose not exceeding in the aggregate half a mile—that is, through 14 hoses of 200 feet each, each hose conveying 150 gallons per minute. And yet he says that in many instances this moderate quantity cannot be obtained.

It appears that the volume of water used annually in London for the extinction of fires is only 1-400th of the total supply—that is to say, not one day's water is used for extinguishing fires in the year. But it must be remembered that fires do not burn with average regularity throughout the year, throughout the day, and throughout the Metropolis, but that they break out at intervals and at particular spots, and, therefore, this comparatively small annual per centage has to be delivered not as a regular per centage of the usual delivery, but in quantities vastly in excess, for the moment, of anything required for the locality in which the fire may be raging. Two thousand gallons per minute is at the rate of about 3 million gallons in the 24 hours—that is to say, when a large fire occurs there should be concentrated at the particular spot a rate of delivery equal to 1-40th of the whole power of the London water supply, or enough to meet the ordinary daily wants of a town of 100,000 inhabitants.

Bearing these facts in mind, it is not surprising that the pipes of the companies, which have been laid with a due regard to economy of capital, large enough merely to supply the needs of the houses—these needs being at the average rate of a pint and a quarter per minute per house, or 227 gallons per house per day—should be inadequate, in many instances, to bring to the scene of a fire 2000 gallons per minute even when delivered at the level of the street for the services of a fire-engine. But there can be no question that to ensure the prompt extinction of fire it would be in the highest degree desirable to be able to supply an effective jet from the water-main, without the intervention of a fire-engine. This has been amply proved by the experience of Manchester, Liverpool, and other towns, where there is, by gravitation in the mains, a constant high pressure, competent to deliver large quantities of water in the form of jets.

This section is not one which deals with engineering matters, but we think we may be pardoned for making a few remarks on the subject of jets. The Metropolitan Board of Works, in their desire to do that which is best for the safety of the inhabitants of London, and to do nothing rashly, more than twelve months ago instructed us, in conjunction with Sir Joseph Bazalgette, to carry out a series of practical experiments upon the question of fire-jets, which should put beyond all doubt the engineering points involved. We may state briefly the result of these experiments. With a very low jet, say of some 30 feet, about seven-eighths of the head or pressure effective at the orifice of the jet will be obtained, as the height of the column of water—that is to say, 40 feet of head at the orifice would give a jet of about 35 feet in perfectly still air; but as the heights of the jets are increased, and increased they must be, if they are to be of any service in extinguishing fires in the most valuable buildings of London—the modern buildings—which are so lofty, the per centage of which the column of water produced bears to the effective pressure producing it becomes less and less, so that for a jet to rise to a height of 80 feet there must be, roundly, a pressure equal to 128 feet. To rise to a height of 100 feet there must be an effective pressure of about 180 feet. Moreover, the higher the jet the greater must be the diameter of the column of water. A small jet, which will attain a respectable per centage of the head producing it, if that head be low, will be unable to cope with the resistance of the air, if the pressure be high.

We do not suppose that this section will care to go into details on this matter; but we will give them, as an instance, a fair average jet required for London purposes. A jet that would rise 80 feet in still air, if of one inch in diameter, would deliver the 150 gallons per minute, and would demand an effective pressure, as has already been said, of 128 feet at the very orifice of the jet; and it might be thought, therefore, that if a pressure could be maintained in the pipes equal to 128 feet of head, when the water was flowing, that all that was desired would be provided. But this is not so. There is the very striking and, to many people, very unexpected consideration of the friction of water through the hose to be taken into account; and this section may, perhaps, little expect to be told that every foot of the usual size of hose employed by the London Fire Brigade, when conveying 150 gallons of water per minute, requires a pressure of a little over 3 inches to drive that water through. As a matter of fact, the 200 feet of hose demands 53 feet of pressure to get 150 gallons per minute through them. Therefore, to obtain a jet 80 feet high, expending 150 gallons per minute at the end of 200 feet of hose, there is needed a pressure at the main of 181 feet, and this pressure must be maintained while the water is flowing.

We believe this section will now well appreciate why it is that if it be difficult for the water companies in many instances to deliver 2000 gallons per minute at the street level, it would become absolutely impossible for them to deliver it were its exit opposed by this 181 feet of pressure. More especially will this section understand the difficulty when they are told that there is not one of the London companies which is bound to give throughout its district this pressure of 181 feet above the pavement, or anything bordering upon it; indeed, the obligations of the largest company but one are fulfilled by giving a pressure of only 40 feet above the pavement—a pressure which, so far from being able to produce a jet delivering 150 gallons at the end of 200 feet of hose, can only succeed in driving 122 gallons per minute through a hose of that length at the ground level without any jet at all.

These things being so, we think that upon this point of the extinguishing of fires, London will no longer be content with the provisions, as regards quantity and pressure, which now prevail. The question now arises, how are the legitimate complaints as regards potable water and water for fires to be met and to be satisfied? There are many who suppose that the defects arise solely from the fact of the supply being in the hands of private trading companies, and who urge that if the undertakings of those companies were acquired by the governing body of the Metropolis, so as to put the whole water supply under one management, every complaint would disappear. But this could not be the case if, after the acquisition of the property by the governing authority, the present system were continued. That system, as is well known, is the obtaining of water for all purposes, either from the Thames, the Lea, or from wells. With the exception of the well supply, the water so obtained is, as we have said, put into depositing reservoirs and is filtered, and is thus treated whether it be used to flush a sewer, or whether it be drunk, and is delivered at one and the same pressure, whether it be required at the basement of a house or for the extinction of a fire. Suppose the governing authority to pursue the same system, and to obtain water from the same sources, obviously, though there might be some economy in management, there would be no radical change, either in quality for drinking, or in the quantity and pressure for fire purposes.

The mere fact of corporation ownership does not change either quality or pressure, although this simple truism is very commonly overlooked. What, therefore, would be the position of the governing authority? They would speedily find they had bought a "white elephant," the possessing of which would, under any ordinary system, compel them to set about finding some unobjectionable source of supply, so that all the water might be fit for potable purposes, and would compel them to alter the pipeage, and also to increase the height to which the water is raised, that it might be available for fire purposes. It is commonly a sufficiently difficult thing to find an unobjectionable source of supply for a town of even 100,000 inhabitants; but, in the case of London, the difficulty of procuring 125 million gallons a day is one of the greatest magnitude.

There have been, as this section well knows, various propositions for bringing the water from the lake districts of Wales and Cumberland by means of gigantic aqueducts to London; but, after full examination by Royal Commissions, these propositions have been rejected; and, moreover, an opinion has been expressed by those commissions that it is not expedient the water supply of any district in England should be taken from the towns in its immediate neighbourhood to supply the wants of a town afar off.

But, assuming that such works could be carried out, the very projectors of them admit that their cost would be enormous. Moreover, they could not deliver the water at a height which would give sufficient pressure without the aid of pumping. The whole of the pumping expenditure, therefore, must be maintained, or, if an adequate pressure is to be kept in the mains for fires, must be extended. Would it be wise for the Metropolitan Authority to acquire at a cost which from numerous instances we could readily show to this section would not be less than £25,000,000 sterling, the undertakings of the present companies, when that acquisition was burdened with the necessity of forthwith discarding the sources of supply, and of forthwith entirely re-arranging and modifying all the distributing apparatus and all the pumping power at an expense of at least as many millions more? We need scarcely say that, rich as London is, such outlays would never be sanctioned. But it is evident that something must be done. London must be supplied with wholesome potable water, and it must have a greater security from fire.

We have reported to the Metropolitan Board of Works, and our report is before the public, that the only practical mode would be to separate the water for drinking purposes and for the extinguishment of fire from the water which is used for all other purposes. Although, as we have said, it is next to impossible to find 125 million gallons per diem of unobjectionable water, it is perfectly possible to find 30 million gallons per diem, or even more than that quantity of water, which is pronounced by all authorities to be of the best possible quality for dietetic purposes—viz., the pure spring water from the chalk. This has been recognized by the Duke of Richmond's commission in their report. Now it will be found that the most liberal allowance of water for drinking and cooking is covered by two gallons per head per diem. And by cooking we mean not only the water used in the saucepan, but the water used in the washing of vegetables and fish, and in otherwise preparing food for cooking. Two gallons per head per diem is only 7 or 8 million gallons for the whole Metropolis. But in our report we have doubled this, and have allowed 16 million gallons.

Our proposition is, that there should be made, on the high ground to the north and to the south of London, reservoirs at a height of 400 feet above Ordnance datum; that these reservoirs should be supplied by pumping-engines, drawing their supply of spring water at distances of from 8 to 15 miles beyond the reservoirs—that is to say, in the open country; that the reservoirs should all be united by large arterial mains traversing London from north to south, and that these mains should be united by subsidiary mains. From these latter mains a service-pipe would proceed to each house, delivering the water into a close vessel having a draw-off tap, and containing, according to the size of the house, from 3 to 10 gallons and filling up gradually, after having been emptied. On these mains also would be placed, at the time they were laid down, the hydrants for fire extinction.

The plan we have proposed would, we believe, overcome every difficulty in providing for the important requirements of (*a*) the potable and (*c*) the fire extinction water; and even if the property of the water companies were acquired by the governing body, this plan, as it seems to us, is the only feasible one by which the present complaints could be satisfied.

If this be so, why should not the plan be at once carried out, leaving the question whether the companies should or should not be acquired by the governing body for after consideration? The two things are distinct. The acquisition of the water companies would be strenuously resisted. It would probably involve years of parliamentary warfare, and during the whole of this time London would be left where it is as regards its water supply.

After very careful calculation we have estimated that the total cost of the whole of the works necessary for carrying out this separate supply of potable water, under sufficent pressure for extinguishing fires, will not exceed £5,500,000, and this includes house fittings and also the hydrants. The annual cost attendant upon such a capital expenditure, and upon the working of the undertaking, will at first sight appear to be large, but, when contrasted with the expense which would be involved in meeting the improved fire requirements alone under any ordinary system, that cost will be found to be considerably less.

The evidence adduced before Sir H. Selwin-Ibbetson's committee showed a very curious state of facts as regards the small annual money expenditure for the preservation of London from fire as compared with other places. For the protection of the 1600 millions of property in London there is accorded an annual sum of a little under £80,000. Of this £80,000, £48,000 arise from a halfpenny rate, £19,000 from a contribution by the fire offices, at the rate of £35 for each million insured, £10,000 from the Government, and £2750 from miscellaneous sources. Let us see now what proportion this sum of £80,000 per annum for the preservation of London from fire bears to the sums expended in other large towns, and the best way of comparing will be by taking the expenditure at per thousand of the population. London, with a population of, say, 3,500,000, and an annual charge of £80,000, spends £22 17s. per 1000. Paris, with 1,986,000 of population, spends £100,000, or £50 0s. 6d. per 1000. New York, with 1,098,000, spends £249,600, or at the rate of £233 14s. per 1000—more than ten times the sum spent in London. Chicago, with 550,000 of population, spends £111,093, or exactly £202 per 1000.

Numerous further instances might be quoted, all of which would tend to show that London, although undoubtedly the most important city in the whole world, as regards population, wealth, and magnitude of the interests involved, is the one that spends relatively the least for the extinction of fire. That London, in such circumstances as these, should suffer so little as it does from disastrous fires, we think must be admitted to be due to the excellent organization of the Fire Brigade, and to the unwearying diligence and assiduity of Captain Shaw. The London Fire Brigade, under his management, has gone on from year to year coping with, and even mastering, the increase in their labours, arising from the increase of London. But it is clear that there is a point beyond which it is impossible for them to protect the Metropolis, unless in some way their powers are increased. This point is certainly reached now, and, in fact, has been reached for some time past.

The report of Sir H. Selwin-Ibbetson's committee clearly recognizes this, for they have recommended in their report that the limit of the rating power for fire purposes should be doubled, thus adding nearly £50,000 per annum to the present income. That committee further recommends that hydrants should be fitted to mains and services wherever there is a constant supply, and should follow the extension of that supply. This, as appears from the evidence, would involve an expenditure of £750,000 at least, which, at 3½ per cent., would cost £26,250 per annum. They also recommend that the water system should be consolidated in the hands of a public authority, which, in dealing with the questions of constant supply, pressure, and pipeage, should be bound to have regard, not only to the convenience of consumers, but also to the requirements for the extinction of fire.

This alteration of pipeage means the outlay of an unknown sum, certainly not less than one million, or an annual charge of £35,000. It further means the increase of pumping power at an increased cost, stated in evidence before this committee, of £150,000 per annum; but it has also been shown by the engineers of the water companies, and we entirely agree with them, that it would be idle to pretend to maintain such a pressure until the house fittings were all altered to suit it, and this could not be effected for less than £3,600,000, which, at 3½ per cent., amounts to £126,000 per annum. These are the sums involved in the recommendations of Sir H. Selwin-Ibbetson's committee, who conclude their report by saying that "effect should be given by the Ligislature to these recommendations."

Let us now contrast the financial results of the two plans:—Purchase of the undertakings of the water companies, £25,000,000, at 3½ per cent., £875,000; alteration of pipeage, £1,000,000, at 3½ per cent., £35,000; annual expenditure of the companies in 1874 was £447,529; say diminished, owing to the concentration of management, £47,529; leaving £400,000; increased cost of pumping for higher pressures required for jets, £150,000; interest at 3½ per cent. on cost of hydrants, £26,250; interest on cost of altered house fittings, £126,000—total, £1,612,250; equal to about 16½d. in the pound on the present rateable value of the Metropolis. We should mention that we have not included amongst these items the extra £50,000 per year expenditure on the Fire Brigade contemplated in the report of the committee, because we are convinced that if a hydrant service with proper pressure be given, not only need there be no increase in the annual charge for the Fire Brigade, but the existing expenditure will be very considerably lessened.

The annual cost of the plan we propose is—interest at 3½ per cent. on £5,500,000, £192,500; working expenses for pumping and management, £32,500—total, £225,000. Equal to about 2¼d. in the pound on the rateable value of the Metropolis.

The gross income of the water companies in 1874 was, as we have stated, £1,137,000, or about 11¼d. in the pound, making, with the 2¼d., a total of 14d. in the pound, as against 16½d., or a saving in mere money of 2½d. in the pound, or close upon £250,000 a year. But it will be seen that, by the dearer process, no improvements whatever have been made in the quality of the drinking water, and that nothing has been attained except a better provision for the extinction of fire, whereas, by the cheaper plan, not only has this latter object been attained, but the difficulty with regard to the most important question of all, that of potable water, has been entirely overcome.

Ashford (Kent) Gas Company.—The annual meeting of shareholders, was held on the 13th inst.—Mr. W. Whitfield in the chair. The report showed that the year just expired had been a very prosperous one. There was a balance of £1900 on the year's working, and the directors recommended paying off debenture bonds to the amount of £300, and the payment of a dividend of £6 per cent., with a bonus of £1 per cent. The report was adopted. The two directors retiring by rotation, Mr. Whitfield and Mr. Bugler, were re-elected, and votes of thanks passed to the directors.

Keymer and Ditchling Gas Company.—The ninth annual meeting was held at the works, Hassock's Gate, on the 16th inst.—Mr. Chilmaid in the chair. The directors report expressed their pleasure in being able to show an increasing and improving business. A balance of £160 10s. 5d. remained in hand, and they recommended that a dividend of 4 per cent. be declared, payable on Nov. 1, 1877 (same as last year); that a sum of £20 be added to the reserve-fund, and that the balance of £6 13s. 5d. be carried to the next year's account. The report was adopted, and the three retiring directors were re-elected. Two vacancies which had also occurred through deaths were filled up. The balance-sheet showed that the total on capital account was £3355 1s. The revenue for the past year had been £989 18s. 2d., including a balance of £133 19s. 7d. brought forward from last year. The expenditure on this account had been £829 7s. 9d., leaving a balance in hand of £160 10s. 5d. The price charged for gas by the company is 6s. 8d. per 1000. The meeting closed with a vote of thanks to the chairman.

LIGHTING BY ELECTRICITY.

[Translated from the *Journal des Usines à Gaz.*]

Two altogether opposite currents (the expression may not seem out of place in speaking of electricity) appear to be produced in the minds of electricians. Some, having at their head MM. Denayrouse and Jablochkoff, are seeking for the divisibility of the light—even announce that they have found it, and speak of its application under conditions identical with those of lighting by gas. Others, of whom the chief is M. Fontaine, on the other hand, concentrate the light, and propose to substitute it for that of the sun, whenever the latter happens to fail us.

If the divisibility of the electric light had really been discovered, and the experiments were practical, it would, at equal price, compete seriously with lighting by gas. But nothing of the kind has taken place, and the only application that has been made of it in the *Magasins du Louvre* has demonstrated the little value of a process which made so much stir at the time of its appearance. We say the little value from a practical point of view, for the beautiful experiments of M. Jablochkoff do not the less retain all their merit when regarded from a purely scientific standpoint. We have treated the question in detail in Nos. 1 and 2 of the *Journal des Usines à Gaz.**

As to the concentration of the light and the formation of a single focus equal to 100, 500, and even 3000 Carcel lamps, it appears to us to be the pursuit of a system of lighting precisely opposed to what is required in most cases. It may be very interesting to wish to imitate the sun. Now, if the sun served only for the lighting of human beings we could charge it with many defects. There is, in fact, no light more irregular, varying not only during the course of a single day, but also with the seasons and latitudes, and in order to use it as a light, we seek to shade ourselves from its direct action by means of sunshades, Venetian and other blinds, &c. The indisputable merits of the sun as a light are that it shines alike for everybody, and that it is costless; and these are precisely the only points to which electricians, and still less gas manufacturers, are unable to attain.

M. H. Fontaine, however, invited us to witness some experiments which were conducted in the Palais de l'Industrie, when "the interior of the palace, the superficial area of which is 12,000 square mètres (129,000 square feet), and the capacity 320,000 cubic mètres (about 11,300,000 cubic feet), was lighted by two focuses of six lamps." M. Fontaine also adds that the hall is rectangular, and that in a round or square building a single focus only might have been employed.

We shall have said *à priori* that such lighting could not but be defective, and experience only confirmed our opinion. The two lustres, each composed of six electric lamps, emitted a pale, dull light, which could not be compared to the direct light of the sun, nor even to that light when tempered by passing through clouds, but rather to those early sunrays which are seen at daybreak on a winter morning. With regard to the direct action of these two six-light lustres, they projected on all sides of the visitors six sharp shadows, as though they had been cut out with scissors, producing the effect of superposed figures in a shadow-show.

M. Fontaine had taken the precaution to distribute among the visitors a notification that, in order to appreciate the intensity of the light, it was necessary to avoid looking at the lamps—a precaution which was, moreover, quite needless, inasmuch as when visitors had once looked at them, they felt no temptation whatever to repeat the operation. And that is very natural. M. Fontaine estimates the luminous intensity of these two focuses as equal to 6000 gas-burners. We shall have to return to these figures, but, accepting them as correct, it will be seen that each lustre was composed of six pencils, each giving the light of 500 gas-burners—that is to say, the light of 3000 burners was concentrated in six focuses, having a surface of only a few square centimètres, while the 3000 gas-burners would have presented a lighting surface of about 6 square mètres (65 square feet). The diffusion of the light was, therefore, nearly *nil*, and this diffusion was simply the result of reflection from the walls of the building.

We say that the problem thus solved is precisely the inverse of that which it was necessary to solve—viz., the infinite divisibility or the diffusion of the light, and instead of concentrating it in one point, it was, on the contrary, necessary to arrive at the greatest possible dissemination. The perfection of lighting would be to render *fluorescent*, so to speak, the surfaces proposed to be illuminated.

With regard to the figure of 6000 gas-burners, indicated by M. Fontaine as equivalent to the luminous intensity obtained, it is a very vague datum. There are gas-burners *and* gas-burners; but if M. Fontaine refers to burners consuming 140 litres (5 cubic feet) of gas per hour, we would willingly agree to make the following experiment:—Light one half of the nave of the Palais de l'Industrie with 3000 of these burners, and the other half with one of M. Fontaine's six-light electric lustres, and allow the public to pronounce an opinion as to best mode of lighting. The half of the nave having a superficial area of 6000 square mètres (64,500 square feet), 3000 burners would be equal to one burner for 2 square mètres, which is equal to daylight. For it must be said that the intensities put forward by the electricians bear such resemblance to the numbers of killed and wounded given in war bulletins, that it would be well if, for once at least, a serious comparative experiment were made.

As this experiment has not been made, we will limit ourselves to saying that, on leaving the Palais de l'Industrie, we noticed the lighting of the Café des Ambassadeurs, in the Champs Elysées, which is effected by means of about 1000 gaslights, surrounded by globes of ground glass. This lighting was fairy-like, while the electric lighting of the Palais de l'Industrie was funereal.

As to the question of economy, it is sufficient to say that the two electric lustres were supplied by twelve of Gramme's machines, driven by two engines each of 25-horse power.

This does not prevent the editors of the large papers from crying out that "the question of the lighting of Paris has just made immense progress;" and for the amusement of our readers we will reproduce a passage from an article in the *Estafette*, of July 10, 1877, recapitulating the trials made in 1855 and 1863 for the lighting of the Avenue de l'Impératrice, and attributing the failure of those trials to a cause which would never have occurred to us:—

"The enthusiasm was great (says the writer of the article), if we judge from the reports of the press. But by all those who very justly selected the Bois de Boulogne as a secluded spot for breathing out their tender passions or their griefs—all those, in a word, who sought solitude, calm, and obscurity—this invention was characterized as mischievous; it was a concert of maledictions. . . . . Therefore the experiments were soon abandoned, and all those who thought to see Paris lighted were grieved at the unfortunate choice of locality that had been made for conducting the experiments."

We believe rather that the vividness of the luminous focus blinded the passers by and frightened the horses, and that the shadows cast by it were so deep as to resemble holes and ditches.

We have now to place before our readers an account of an experiment made at Rouen early in July, at which we were present. The occasion was a concert for the benefit of the workpeople in the establishment of Loys, given in the garden of the Hôtel de Ville, which was illuminated by six electric lights, each estimated to be equal to 500 jets, and placed about 6 mètres (about 20 feet) from the ground. The lights were surrounded by double ground glass globes, so as not to blind the visitors. We think these ground glasses absorbed at least 50 per cent. of the light.

The *Journal de Rouen* says: "According to the figures kindly communicated to us by M. Lemonnier, taking account of all the expenses of amortization, maintenance, and any other outlay that may be occasioned by the use of the electric light, the cost for each evening amounts to 177 fr. 85 c. (£7 2s. 6d.). Under the same conditions, the cost of lighting by gas would amount to 285 fr. (£11 8s.), being a difference of at least 107 fr. 15 c. (£4 5s. 6d.) each evening in favour of the electric light; and if we remember that about 25 concerts per annum are given, there will be altogether a saving of about 2678 fr. 75 c. (about £107.)."

Now this calculation is altogether wrong, even admitting the figure of 177 fr. 85 c. for the electric light. It is evident, in fact, that the pretended 3000 jets of electric light would be advantageously replaced by 1000 gas-burners, each consuming 105 litres (3·7 cubic feet) of gas per hour, placed in groups of 18 or 20, upon gaseliers disposed about the walks of the garden. They would throw on to the ground a light, at least, equal to that given by the electric lamps, and would be more agreeable to the sight. These 1000 burners would cost for each concert, with two hours lighting—

	Fr. c.	Sterling.
1000 burners × 105 litres × 2 hours × 0 fr. 32 c.	67 20	£2 14 0
Lamplighting	4 80	4 0
Total	72 00	£2 18 0
Interest and sinking-fund at 10 per cent. on a capital of 15,000 francs to be expended in fitting up the gas, 1500 francs, or for each concert	60 00	2 8 0
Total	132 00	£5 6 0
The electric light costs	177 85	7 2 6
Difference in favour of gas	45 85	£1 16 6

Besides, it must be remarked that the concerts given by the Municipality of Rouen in the Jardin St. Ouen are for the benefit of the poor, and that the gas company are obliged in this case to supply the gas at 17 centimes per cubic mètre (about 4s. per 1000 cubic feet). We should then have—

	Fr. c.	Sterling.
210 cubic mètres at 17 c.	35 70	£1 8 6
Lamplighting	4 80	4 0
	40 50	£1 12 6
Interest and sinking-fund	60 00	2 8 0
Total	100 50	£4 0 6
Electric lighting	177 85	7 2 6
Difference in favour of gas	77 35	£3 2 0

The city would therefore realize for its 25 concerts a saving of 1146 fr. 25 c. (£45 17s.) in the former case, and 1933 fr. 75 c. (£77 7s.) in the latter.

With regard to the effect produced, it was the same as at the Palais de l'Industrie. Every one sought the shelter of the trees in order not to be inconvenienced by one of the six electric lights, which were always in the field of vision. The only agreeable thing was the projection of the light on to the fountain, and on to the magnificent tower of St. Ouen, by means of a reflecting lamp. But that does not come into the question of lighting; it is a matter of decoration and illumination.

* See JOURNAL OF GAS LIGHTING, vol. xxix., p. 977.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

In the iron trade there has been little or no change of note during the week, except that some brands of pig iron can be had for rather less money than a fortnight ago, now that it is seen that the stocks elsewhere continue to increase, notwithstanding the general effort to restrict the production. In this district there is very little inquiry for forge pig, and the transactions in foundry brands are not on a large scale. Current quotations for North Yorkshire pig are about the following:—No. 1 foundry, 44s. 6d.; No. 2 foundry, 42s. 6d.; No. 3 foundry, 40s. 6d.; No. 4 foundry, 40s.; No. 4 forge, grey, 39s.; No. 5 forge, mottled, 38s. 6d.; No. 6 forge, white, 38s.; refined metal, 57s.; Kentledge, 42s. 6d.; and cinder, 36s. Scotch ballast pig is 47s. 6d., f.o.b. Hematite "ordinary," Nos. 3, 4, and 5, are 65s.; and "Bessemer," 65s. to 70s. "Aireside" Leeds, No. 1, 53s.; No. 2, 49s.; No. 3, 47s.; No. 4, 46s.; Forge, 46s.; M, 45s.; and W, 44s. "Acklam Yorkshire"—No. 1, 45s.; No. 2, 43s.; No. 3, 41s. 6d.; No. 4, 41s.; and forge, 40s. Lincolnshire, 45s. to 57s. 6d., all per ton.

In the local and district coal trade there is some reason for fearing that a very serious crisis may be impending. The members of the South Yorkshire and North Derbyshire Coalowners Association, Limited, met at Sheffield last week, and determined to give notice to the men of an immediate reduction in the rate of wages, that step being declared to be rendered absolutely necessary by the continued depression of trade, and the consequent low prices realized for all classes of fuel. It was further resolved to communicate with the representatives of the miners, in order to confer with them for the purpose of settling the question in an amicable manner. On their part the men are not surprised by the notice, which they have been expecting for some time past. They have lately reorganized their society, and are said to be determined to resist the attempted reduction, which will probably be 5 per cent., by which amount the miners are now paid in excess of the wages of 1871. Should the coalowners, therefore, persist, it is probable that a strike will ensue. At present the coal exports are on a rather larger scale, the Humber shipments last week having been over 32,000 tons.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is very little change to report with regard to the coal trade of this district. The approaching close of the season for the making of the gas coal contracts has brought a few more inquiries into the market for this class of fuel, but as supplies generally are plentiful, no higher prices are obtainable, and the average quotations at the pit mouth may be given as under:—Good screened Arley, 8s. 6d. to 9s. per ton; and screened Wigan four-feet, 7s. 6d. to 7s. 9d. and 8s. per ton. For other classes of round coal there is only a very limited demand. The better classes of round coal for house fire purposes meet with only a very small inquiry, and common classes of round coal, suitable for furnace purposes, are quite a drug upon the market, and at the pit mouth range from 10s. to 10s. 6d. per ton for good Arley coal, 8s. to 8s. 6d. for Pemberton four-feet, and 6s. to 7s. per ton for common coal, according the quality. For engine classes of fuel there is still a very fair demand, and prices generally are maintained, but with the exception of the better classes of slack there is no scarcity in the market, and the average quotations at the pit mouth may be given about as under:—Burgy, 5s. to 5s. 6d. per ton; and slack, 3s. 6d. to 4s. 6d. per ton, according to quality.

The shipping trade shows a slight improvement, but for export there is still very little inquiry, and to secure orders very low prices have to be accepted.

In the iron trade of this district there is no improvement to report; but, if anything, business is rather worse. Local makers of pig iron have reduced their list quotations about 1s. per ton, and north country makers are not so firm as they were; but there is very little new business doing, and for delivery into the Manchester district quotations may be given as under: Lancashire, No. 3 foundry, 53s. per ton; do., No. 4 forge, 52s. per ton, less 2½ per cent.; Middlesbrough, No. 3 foundry, 48s. 9d.; No. 4 foundry, 48s. 3d.; and No. 4 forge, 47s. 9d. per ton, net cash.

The finished iron trade is without material change; and as prices have now reached about their lowest point, it is only in special cases that any concessions upon late rates are accepted.

The report of the Wigan Coal and Iron Company submitted to the half-yearly meeting of the directors, held last week, affords a very fair indication of the state of trade in this district. For both coal and iron, the report stated the demand had decreased, whilst prices had also shown a downward tendency, and to enable the directors to declare a dividend at the rate of 3½ per cent. it was necessary to draw upon the reserve-fund to a considerable extent.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England was a little quiet last week; recent prices were barely maintained. There was a falling off in the inquiry for steam coals. Several of the second-class pits wrought short time. The best collieries, however, worked ten days per fortnight. What may be called the autumn shipments of gas coal have commenced. There was a pretty steady demand last week for gas coals from the smaller gas-works in the South, and some cargoes were despatched to the West of England. The large gas collieries go on steadily with their contracts, and a good deal of gas coal is sent to France for the large gas-works of Paris and other towns. In the open market the best demand is for medium sorts of gas coal, at about 7s. 6d. per ton, as inferior gas coal are very much mixed up with manufacturing sorts, and as all these are in abundance, prices, as previously reported, are irregular.

The supply of tonnage for the coasting trade is in excess of the demand. Steamers are paid 4s. 3d. per ton for London, and small sailing ships realize between 5s. and 6s. per ton, to deliver at the wharves. The rates to the British Channel and to the French ports are practically unaltered. A good few collier sailing ships are trading with coals to Holland, at about 7s. per keel. The outward business to the Baltic remains in the same depressed condition as last week. £5 per keel cannot now be realized for Cronstadt, and there are moderate shipments for the other ports of that sea. There is rather a better inquiry for gas coals from the Italian ports of the Mediterranean; and, as home rates from that sea are wretchedly poor, a little more money has to be paid in freight upon outward shipments.

The iron market in the Cleveland district has been dull during the week. There has not been much fresh inquiry for pig iron, but there have been pretty steady deliveries for shipment, and for the general home trade. The manufacturing iron trade is likewise dull. Iron shipbuilding is kept busy; but, generally speaking, the manufacturing trade of the North of England shows very little animation.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The Town Council of Paisley, at a meeting held last Tuesday evening, in their capacity as Gas Commissioners, resolved to continue the price of gas for the current year at 4s. 2d. per 1000 cubic feet. There was no less a sum in the bank than £9977 15s. 9d. at the credit of the Gas Trust. The amount of coal in stock was reported to be 2345 tons, and 3549 tons had been received during the past month. During the month there had been manufactured 3,378,000 cubic feet of gas, the increase over the consumption of the previous month being 176,000 cubic feet, and the illuminating power was equal to 28·31 standard candles. Mr. G. R. Hislop, the manager of the works, reported to the committee that the tank for the new gasholder had been completed. Negotiations for the purchase of additional ground near the gas-works were making satisfactory progress.

The annual general meeting of the Sanquhar Gas Company was held on the 15th inst.—Mr. Thomas Shaw, chairman, presiding. After the accounts for the past year had been submitted and considered, the following dividends were declared:—2½ per cent. on the ordinary stock of the company, and 5 per cent. on the preference stock. It was remarked that the reduction in the ordinary dividend was due to a payment from the revenue account towards the reduction of capital. No alteration was made in the price of the gas, and all the office-bearers were reappointed.

At the annual meeting of the Mid-Calder Gaslight Company, held a few days ago, a dividend of 6 per cent. was declared upon the shares out of the profits of the gas undertaking for the past year.

Judging by the proceedings of the annual meeting of the Forfar Gas Commission, which was held on the evening of Monday, the 20th inst., the gas affairs in that town have been making a backward rather than a forward movement. At the meeting in question, a minute of the Managing Committee was read, recommending that the estimates for the year to the 15th of June, 1878, be submitted to the meeting. They bore on the revenue side that the quantity of gas required at 5s. 10d. per 1000 cubic feet (which is 10d. per 1000 more than last year), would be 17,500,000, yielding £5104 3s. 4d.—less discount, £4848 19s. 4d.; meter-rents, £230; residual products, £200—total, £5278 19s. 4d. The estimated expenditure amounted to £5277, including £2200 for coal; salaries, £910; interest, £270; sinking-fund, £150; annuities, £661; and depreciation, £209. The probable surplus was estimated at £1 19s. 4d. Mr. Craik, in the absence of the convener, explained that last year the price was reduced to 5s. An idea had prevailed throughout the town, and also amongst the commissioners, that this reduction had caused a loss, but that, he said, was a mistake. The motion which he then proposed, and which was seconded by Mr. Rutherford, showed the revenue to be the same, but £600 profits of two previous years had been brought forward to reduce the price of gas. The commission could not, however, make gas at 5s., so that the price this year would have to be increased to 5s. 10d., and he moved accordingly. Bailie Doig seconded, and the motion was unanimously agreed to. There has evidently been blundering somewhere. To reduce the price 20d. per 1000 feet one year, and to advance it 10d. the next, surely does not indicate good financial management. To swallow up £600 of accumulated profits in a year, and say there was no loss on the year's transactions, may be a very ingenious way for Mr. Craik to smooth over the blunder for the commission, but it is hardly creditable to his arithmetic. It was no justification of the previous reduction to say that Mr. Rutherford seconded it, if it was wrong. To put up Mr. Rutherford as a shield only suggests the remark that, if that gentleman and others had still been amongst the commissioners, the price of 5s. might still have been maintained. Certain defalcations have recently been brought to light in connexion with the collector's office at the gas-works, and these seem to have opened the eyes of the consumers in a way that was never expected.

An extraordinary meeting of the shareholders of the Pittenweem Gas Company was held on the 20th inst., to consider an offer of arrangement with the late manager—Mr. John Cook Reckie—who some time ago resigned his appointment under circumstances which have caused no little discussion in the locality. The directors were empowered to endeavour to come to a satisfactory arrangement, and to appoint a new manager.

The Police Commissioners of Burntisland, at a meeting held in the early part of last week, adopted a report submitted to them recommending many improvements in the lighting of the thoroughfares in the burgh, and appointed a committee to see the recommendations carried out.

Owing to the long continued heavy rains, the water recently burst in under the concrete way at the new gas-works, Lochee, and caused considerable damage. Active steps were at once taken to repair the damage, and to prevent a like occurrence happening again.

The usual report upon the quality of the gas supplied in Edinburgh was submitted by Mr. J. Falconer King, the public analyst, to the meeting of the Town Council of Edinburgh, held last Tuesday. It showed that the Edinburgh Company's gas had an illuminating power equal to 29·10 standard candles, and that of the Leith Company had an illuminating power of 26·80 candles.

The agitation in connexion with the election of Police Commissioners for the burgh of Wishaw is now in progress, and from the remarks made by some of the candidates in their electioneering speeches, it would seem as if there was a decided feeling in favour of the acquisition of the gas-works of that town by the municipal authorities, under the provisions of Sir Windham Anstruther's Burghs Gas Supply Act.

One of the most important events of the whole year in connexion with gas affairs in Scotland took place last week—namely, the consideration of the financial statement of the Glasgow Corporation Committee on Gas Supply. On the recommendation of the committee it was resolved by the town council last Thursday to reduce the price of gas from 4s. 2d. to 4s. per 1000 cubic feet, which is now the lowest rate in Scotland, with the exception of that charged at Coatbridge and Galashiels, which it may be remembered is 3s. 9d. per 1000 feet. The quantity of gas sold or accounted for during the past year was 1,492,589,000 feet, being an increase of 5·4 per cent. over that of the preceding year. The leakage is 1 per cent. less than in the year ending May 31, 1876. The greatest consumption last winter in 24 hours was 10,329,000 cubic feet, as compared with 9,982,000 feet in the previous year. During the year 24,497 yards of new mains, and 3597 new service-pipes had been laid, and the number of meters in use was raised to 123,769, the increase for the year being 5171. In the course of the discussion which took place over the minutes, attention was drawn to the question of guarantee gas deposits left by consumers in the hands of the Gas Committee, and which now amount to nearly £15,500; and the result of the discussion was that those consumers who can show that they have paid their accounts regularly for two or three years will have their deposits returned on making application for the same. At the Police Board meeting, held on the preceding Monday, Bailie Collins, as treasurer, made his annual financial statement, in the course of which he said that in regard to the police department he observed that the statement which had been made up showed a small excess of income over expenditure, but at the time it was made up the treasurer was not aware that the Gas Committee of the Town Council were prepared to recommend a reduction in the price of gas. No doubt the Police Committee would get the full benefit of that reduction. He did not think they got the full benefit they were entitled to. The Police Committee were amongst the best customers the Gas Committee had, and they were entitled to be treated as wholesale consumers. For the inspection of meters and other things the general consumers put the Gas Committee to an expenditure of something like 10 per cent. over the whole gas consumed, but the Police Committee put the Gas Committee to no expense in that respect. In Edinburgh he knew things were differently managed, and he trusted when the matter came up before the Gas Committee on Thursday that they would take a very liberal view of the case. In the estimates an increase of £4068 was put down for lighting public streets, and £1090 for the lighting of common stairs, or an increase of upwards of £5000 on that department. He supposed the members were aware of the cause of that. It was resolved by the committee to do away with all the rat-tail burners, and substitute in their place larger burners. The expense of that amounted to upwards of £4000. No doubt the citizens would not grudge that increased expenditure, for the result had been a great improvement in the lighting of the city.

My gas news being already so full, I must reserve my water notes and some additional gas jottings till next week.

The pig iron warrant market has been somewhat languid and drooping during the past week, and the closing price on Friday afternoon was 4d. per ton lower than that of the previous Friday.

A very uncertain condition still prevails in the Scotch coal market. Shipping on the Clyde is far from being busy, and the ironmasters are now able to throw a larger quantity of coal into the market, thereby affecting the sales of the ordinary sale colliery owners.

Sale of the Stoke Gas-Works.—On Monday, Aug. 20, an extraordinary meeting of the shareholders of the Stoke, Fenton, and Longton Gas Company was held, to consider the proposed sale of the property and undertaking of the company to the Corporation of Stoke-upon-Trent, upon the terms embodied in a draft provisional agreement already reported in our columns. A resolution was unanimously adopted approving the same.

Reductions in the Price of Gas.—The Corporation of Carlisle, on the recommendation of their Gas Committee, have reduced the price of gas from 3s. to 2s. 9d. per 1000 cubic feet. At Peterborough a reduction of 2d. per 1000 feet is announced from the 1st inst., and at Kidsgrove a reduction of 3d. At Lancaster a reduction of 3d. has also taken place, making the average price 4s. per 1000.

Society of Arts Honours.—In the list of candidates who this year passed the Technological Examinations, appears the name of Mr. Benjamin Akroyd (of the Elland Science School) in "Gas Manufacture, 1st Elementary, with the prize of £5." Mr. Akroyd is a chemist in the establishment of Messrs. R. Dempster and Sons, and last year obtained the prize of £2, given by the Bath Gas Company. Mr. John Dempster, of Elland, passed in the 2nd "Elementary," and his brother, Mr. Robert Dempster, in the 2nd "Advanced." The latter also took, at the same time, the society's prize of £5, and Mr. Hepworth, an assistant in the firm, obtained the society's prize of £7. Mr. William Foulson, of the Oldham Science School, passed in technology on the subject of gas manufacture.

Boring for Water at Stafford.—An interesting experiment is being made by the Stafford Town Council, in order to obtain a good water supply for the town. By boring to a depth of about 600 feet by means of the Diamond Rock-Boring process, they hope to penetrate the water-bearing rocks of the new red sandstone formation, which exists widely in Staffordshire, and in many places lies at an elevated level. A depth of 300 feet has already been bored. It was asserted by many eminent geologists that extensive beds of rock salt existed in the variegated marls above the bunter rocks. This opinion has been found to be correct, for a bed of rock salt, 40 feet in thickness, has been perforated as well as various smaller veins; but

the engineers find that the brine can be effectually "tubbed out" by means of iron lining tubes. A considerable length of time must necessarily elapse before the water-bearing rocks are entered.

SALE OF THE SHREWSBURY WATER-WORKS.—On Monday, the 20th inst., a special meeting of the Shrewsbury Water-Works Company was held for the purpose of considering an offer made by the Corporation of Shrewsbury for the purchase of their undertaking. The chairman (Mr. G. M. Salt) referred to a report which had been circulated amongst the shareholders, informing them of the circumstances of the negotiation of the directors with the council, and the reasons which led them to accept the terms of purchase offered, and to recommend them to the adoption of the shareholders. He then moved—"That the offer made by the Corporation of Shrewsbury to purchase the water-works (subject to the mortgage of £6000 charged thereon) for the sum of £40,000 be, and the same is hereby accepted." The motion was adopted, and a further resolution was passed, to the effect—"That the directors be and are hereby authorized to take the necessary steps to execute the requisite contracts and assurances for carrying out the sale to the corporation in such a manner and on such conditions with respect to the period of payment and other details as they may deem advisable."

KIDSGROVE GAS COMPANY.—The seventh ordinary meeting was held on the 16th inst.—Mr. J. Gater in the chair. After the secretary, Mr. T. Wardle, had read the notice convening the meeting, the chairman read the report, which showed that the company were in a very flourishing condition; the consumption of gas was steadily increasing, so much so that a new gasholder was in course of erection to enable the company to meet the demand. The report and accounts, as read by the chairman, were adopted. The usual dividend of 10 per cent. was declared and passed. Mr. John Maddock was re-elected as a director, and Mr. T. Hulme, of Wolstanton, as auditor. After the close of the ordinary meeting, an extraordinary meeting was held, for the purpose of considering the application of the Audley Local Board to give up the company's right over that part of the parish of Audley, including Audley village and its surroundings, which they now hold under their Act of Parliament. After an explanation from the directors, a resolution was passed granting the application upon payment of the expenses of the transfer.

WHITEHAVEN PUBLIC LIGHTING.—At the meeting of the Trustees of the Town and Harbour of Whitehaven on the 9th inst.—the chairman (Mr. Musgrave) asked what communication had been received from the gas companies respecting their tenders for the lighting of the town. The clerk stated that he had received a communication from Mr. Alfred Penny, in reply to one from him, asking that a reduction of 7½ per cent. from the prices of 1875 and 1876 should be made, and which stated that he had revised his estimate, and could not see his way to make any reduction in the original prices. A letter was also read from the manager of the old gas company, stating that they had also revised their estimate, but could not see their way to reduce the amount. Dr. Dickson observed that the replies were word for word with each other. The chairman said it seemed to him that they were entirely in the power of the gas companies, and they would either have to pay their price or remain in darkness. He had thought that a company who were able to pay 15 or 20 per cent. ought to have had more consideration. He could inform them that he had received an estimate from a very good firm, who offered to light the town and harbour for an amount which would be a saving of £310 a year. And the amount of saving would not only be economy on their part, but he had very reliable authority for saying that they would have a better light. He would suggest that they should accept the tenders of the two gas companies, and that for the future they should make arrangements for having gas-works of their own, or having the town lighted by some other means. He believed that the lighting of several towns in the South of England by petroleum had been adopted with great success. He would propose that they should accept the tenders of the gas companies at present, on condition that a proportionate deduction should be made from the price estimated from the 1st of August up to the present date; or rather to the time that the lamps were lighted. Major Spencer seconded the chairman's proposition, which was agreed to.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

3134.—BORRADAILE, T. S., Old Broad Street, London, "Improvements in the construction of apparatus for regulating the consumption of gas." A communication. Aug. 17, 1877.

3143.—THOMPSON, W. P., Liverpool, "Improvements in and appertaining to ball or spherical valves." A communication. Aug. 18, 1877.

3159.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in effecting the conversion of hydrocarbons and other combustible liquids into gas, and in apparatus or means employed therein, and in or for the production and application of gaseous mixtures." A communication. Aug. 20, 1877.

3166.—ALLAN, W., Kilbirnie, N.B., "Improvements in and connected with mine and other pumps." A communication. Aug. 20, 1877.

3189.—MATHER, W., Salford, Lancs, "Improvements in apparatus for boring and well sinking." Aug. 22, 1877.

3191.—ROBBINS, J., Bartholomew Road, N.W., London, "An improved joint for water and other pipes." Aug. 22, 1877.

3199.—SUTCLIFFE, H. and W., Halifax, York, "Improvements in water taps." Aug. 23, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION. have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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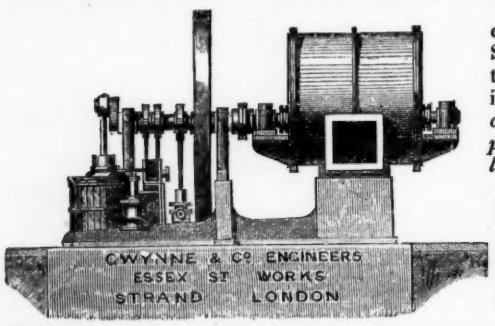

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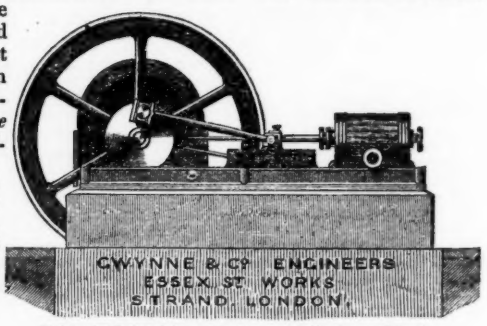

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May 30, 1877.

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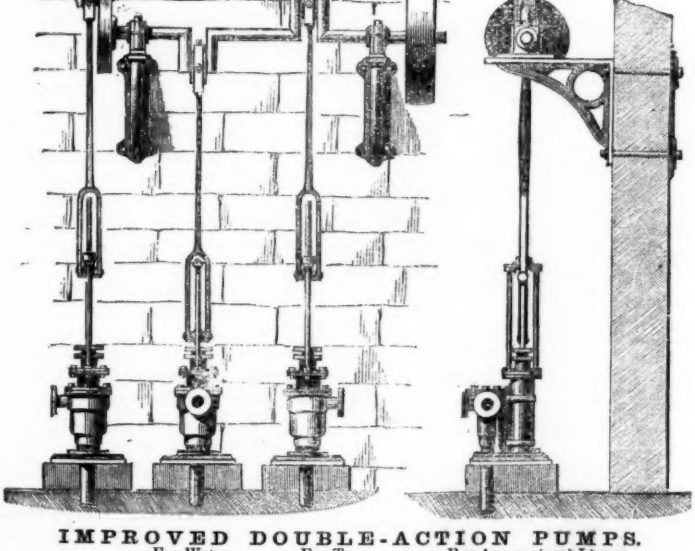

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THE Skelmersdale Local Board require TENDERS for—No. 1, about 120 GAS LAMP-POSTS for streets within their district; No. 2, about 400 GAS-METERS of various sizes, as may be required.
Parties tendering must send designs and prices per Lamp-Post and Meter respectively, delivered at Skelmersdale Station.
Tenders, endorsed "Tender for Lamp-Posts" or "Meters," as the case may be, to be sent in not later than Monday, the 3rd of September next, and addressed to the Chairman, Local Board, Skelmersdale, near Ormskirk.
The Board do not bind themselves to accept the lowest or any tender.

EDWARD BOOTH, Manager.

SURREY CONSUMERS GAS COMPANY.

NOTICE is hereby given that the HALF-YEARLY ORDINARY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the Terminus Hotel, London Bridge, Southwark, on MONDAY, the 1st day of October next, at Three o'clock in the afternoon precisely, to receive the Directors Report and Accounts for the Half Year ended the 30th of June last, and to declare a Dividend.

The Books for the Transfer of Shares will be closed on Saturday, the 15th of September, until the day of Meeting.

W. P. BODDY, Secretary.

Rotherhithe, Aug. 20, 1877.

THE Directors of the Romford Gas and Coke Company, Limited, are prepared to receive TENDERS for the surplus TAR produced at their works for a period of Twelve months, from the 6th of September next.

Offers to be endorsed "Tender for Surplus Tar," and sent in not later than the 6th proximo.

By order of the Board,

W. G. WILSHAW, Secretary.

South Street, Romford, Essex, Aug. 25, 1877.

THE Directors of the Biddulph, Bradley Green, and Black Bull Gas Company, Limited, are prepared to receive TENDERS for the LEASE of their WORKS for a term of Five years.

Tenders to be sent in to the Secretary on or before Saturday, Sept. 22, 1877.

Particulars may be obtained from the Secretary.

The Directors do not bind themselves to accept the highest or any tender.

CORNELIUS E. LAMB, Secretary.

98, West Road, Congleton.

TENDERS FOR TAR.

THE Directors of the Cork Gas Consumers Company are prepared to receive TENDERS for their surplus TAR, for One year from the 1st of September next. The quantity for sale will be about 150,000 gallons, and will be delivered at the Company's Works, or by tank trucks into vessels at quay near works.

Any further information can be obtained by application to the Secretary, to whom tenders must be forwarded not later than the 5th of September next.

By order,

DENNY LANE, Secretary.

Cork Gas Consumers Company,

Offices, 72, South Mall, Cork, Aug. 11, 1877.

THE Corporation of Salford invite Tenders for the supply and erection of a Wrought-Iron FOOT-BRIDGE, to be erected over the London and North-Western Railway, to form a connexion between the No. 2 and No. 3 Gas Stations, situate at Regent Road and Liverpool Street.

Plans and specification can be seen, and all particulars obtained, on application to the Engineer, Mr. Samuel Hunter, Gas-Works, Lamb Lane, Salford.

Tenders, endorsed "Wrought-Iron Foot-Bridge," to be delivered to me on or before the 4th of September next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,

CHRIS. MOORHOUSE, Town-Clerk.

Town-Hall, Salford, Aug. 17, 1877.

DEVIZES CORPORATION WATER-WORKS.

THE Town Council of the Borough of Devizes, acting as the Urban Sanitary Authority, desire to receive TENDERS for carrying out the Works specified in the following Contracts.

CONTRACT No. 2.—For the manufacture and delivery of about 15,000 yards of Cast-Iron SOCKET-PIPES, varying in diameter from 8 in. to 3 in., and the necessary Special Castings.

CONTRACT No. 3.—For the LAYING of the Cast-Iron Water-Pipes, and fixing Sluices, Hydrants, &c.

The plans, sections, and specifications, &c., may be seen at my Offices, in Devizes, or at the Office of the Engineer, Mr. Henry Tomlison, 4, Bene't Street, Cambridge.

Tenders are to be delivered at my Office on or before Twelve at noon, on Monday, the 10th of September next, sealed, and endorsed respectively, "Tender for Pipes, &c.," "Tender for Pipe-Laying."

The Corporation do not bind themselves to accept the lowest or any tender.

A. GRANT MEEK, Town-Clerk.

Devizes, Aug. 24, 1877.

NOTICE.

MESSRS. THOMAS DOCWRA & SON, Contractors, Balls Pond Road, hereby give notice that they have no business connexion with any other person of the same name.

TO GAS COMPANIES.

WE beg to call attention to our special STEATITE BURNERS for Street Lamps. Sample gross 8s. Quotations for quantities.

Messrs. TINDALL AND TELLING, Gas Apparatus Works, 74, Wynford Road, Penton Street, LONDON, N.

HENRY LYON,

ENGINEER,

AND

CONSULTING GAS ENGINEER,

BARTON HOUSE, opposite BARTON ARCADE,

DEANSGATE, MANCHESTER.

Now ready, price 5s., by post 5s. 3d., cloth, 8vo., gilt lettered,

SULPHUR COMPOUNDS IN GAS.

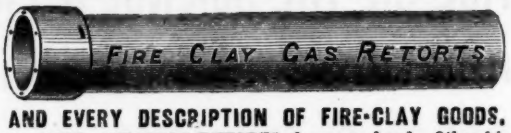
A full Report of the Evidence given before the Select Committee of the House of Commons on the Bills of The Gaslight and Coke Company and the Crystal Palace District Gas Company in the present Session.

LONDON:

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, E.C.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,



AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

THE THAMES BANK IRON COMPANY,

(Successors to LYNCH WHITE,)

SUPPLY FROM STOCK

CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

ADDRESS—

OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.

J. EDMUNDSON & CO.,

19, GREAT GEORGE STREET, WESTMINSTER,

LONDON, S.W.,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

CONTRACTORS FOR THE

ERECTION OF GAS-WORKS, GAS-FITTINGS, &c.,

FOR TOWNS, COUNTRY MANSIONS, &c.

Estimates given free of Charge.

J. & J. BRADDOCK,

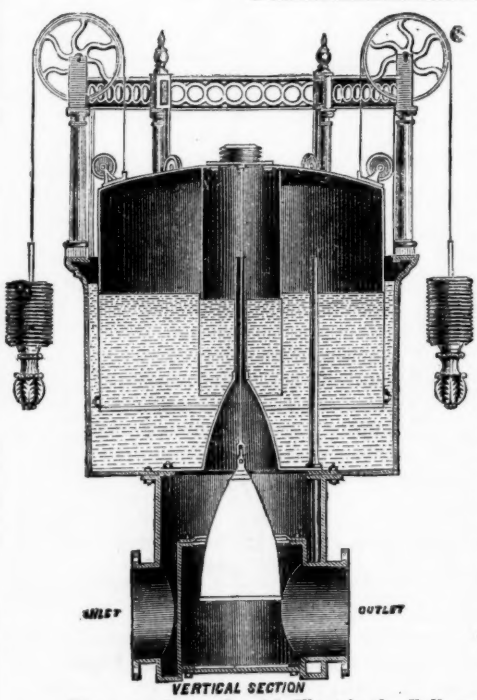
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

IRONFOUNDERS AND CONTRACTORS,

GOWTS BRIDGE WORKS,

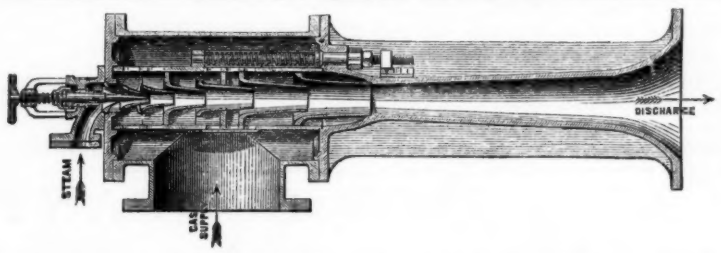
LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.



KÖRTING'S STEAM-JET GAS-EXHAUSTER.

IMPROVED CLELAND'S PATENT.

UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

KÖRTING BROS.,

17, LANCASTER AVENUE, MANCHESTER,

OR TO

GERALD J. TUPP, 8, John Street, Adelphi, W.C.,

LONDON,

SOLE AGENT FOR ENGLAND AND WALES.

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

SQUARE STATION-METERS, with PLANED JOINTS;

ROUND STATION-METERS, WITH CAST-IRON STANDS;

WET AND DRY CONSUMERS GAS-METERS, GOVERNORS, &c.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

ALFRED LASS,

SPECIAL ACCOUNTANT FOR GAS COMPANIES,

30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.

The above forms are registered.

Water Companies Accounts also prepared and adjusted.

CONSULTATIONS.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Improved Retort-Settings. Guaranteed to heat and wear well, with great economy of Fuel.

Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.

Apply to Mr. THOS. NEWBIGGING, Consulting Gas Engineer, 5, Norfolk Street, MANCHESTER.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of

CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

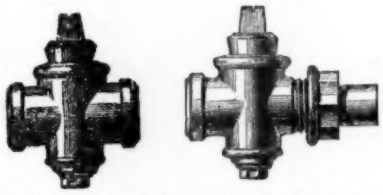
LAMBERT'S

CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:

SHORT STREET, LAMBETH, LONDON.

BOUCK & CO., LIMITED,
TAR DISTILLERS & MANUFACTURING CHEMISTS,
MILES PLATTING, MANCHESTER.

BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS,
&c., &c.,
SCOTSWOOD FIRE-BRICK WORKS,
SCOTSWOOD-ON-TYNE.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,534 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

E. & W. H. HALEY,
General Ironfounders and Makers
OF
CAST-IRON GAS AND WATER PIPES.
Sizes 1½ to 15 inches.
LISTER HILLS FOUNDRY, BRADFORD, YORKSHIRE.

JAMES MILNE & SON,
GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
EDINBURGH, AND
2, KING EDWARD STREET,
NEWGATE STREET, LONDON.
Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

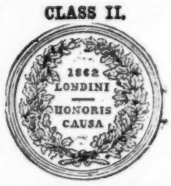
STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES,
CHANDELIERS, BRACKETS, &c.,
And every description of Gas-Fittings and Gas Apparatus.

THE WIGAN COAL & IRON COMPANY,
LIMITED.
DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;
Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.
N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known
HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

1862.

PATENT ANTIMONY PAINT.
MADE ONLY BY
GEORGE HALLETT & CO.,
296, ROTHERHITHE, LONDON, S.E.

CLASS II.



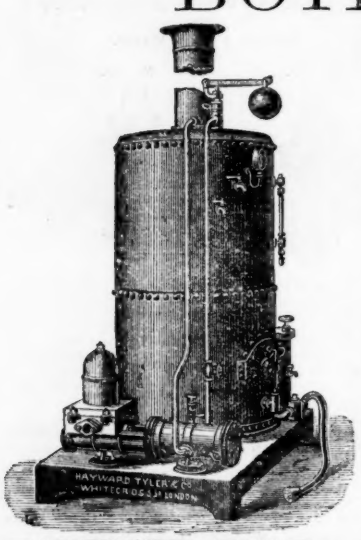
This Paint having been in general use over fifteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

The following Gas Companies in London have used the Paint for years—viz., The Gaslight and Coke, Imperial, Independent, City of London, Commercial, London, and Surrey Consumers.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt.,
as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints,
for which purpose it is superior to White Lead.
SPECIAL DRIERS FOR ANTIMONY PAINT SUPPLIED.

BOILER FEEDERS.
HAYWARD TYLER & CO.'S PATENT.



TESTIMONIALS.

Ratcliff Gaslight and Coke Company,
New Crane, Wapping, London, July 25, 1872.

MESSRS. HAYWARD TYLER AND CO.

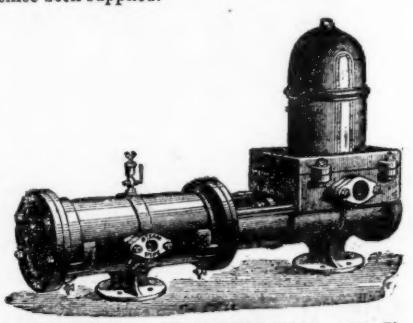
DEAR SIRS,—Have you one of your "Universal" 4-inch by 3-inch Steam Pumps in stock, and how soon could it be delivered? It is for pumping ammonia water, and should have cast-iron clacks. The one I have works capitally.—Yours, in haste, (Signed) HY. E. JONES.

N.B.—Two more have since been supplied.

Gas Company's Office, Luton, Beds, Aug. 30, 1873.
Messrs. HAYWARD TYLER AND CO.

GENTLEMEN,—The 9-inch by 6-inch Steam Pump which I had from you worked in a most satisfactory manner, and perfectly answered the purpose for which it was required. I used it for emptying a gasholder-tank, and for refilling it with water. The quantity of water delivered was far beyond my expectations.

Steam was led into it from our Stationary Engine Boilers, through 1½-inch wrought-iron pipe, a distance of about 90 feet; the whole occupied a fitter less than a day, and work commenced without loss of time.—Yours truly, (Signed) W. PHILLIPS,
Engineer of Luton Gas Company.



SOLE MAKERS:
HAYWARD TYLER & CO., 84, WHITECROSS STREET, LONDON, E.C.

IMPROVED
COMPENSATING GAS-METER.
HUNT'S PATENT.

This Meter supplies a want long felt, by putting an end to the loss sustained by Gas Companies through the overworking of their Meters.

EXTRACTS FROM REPORTS.

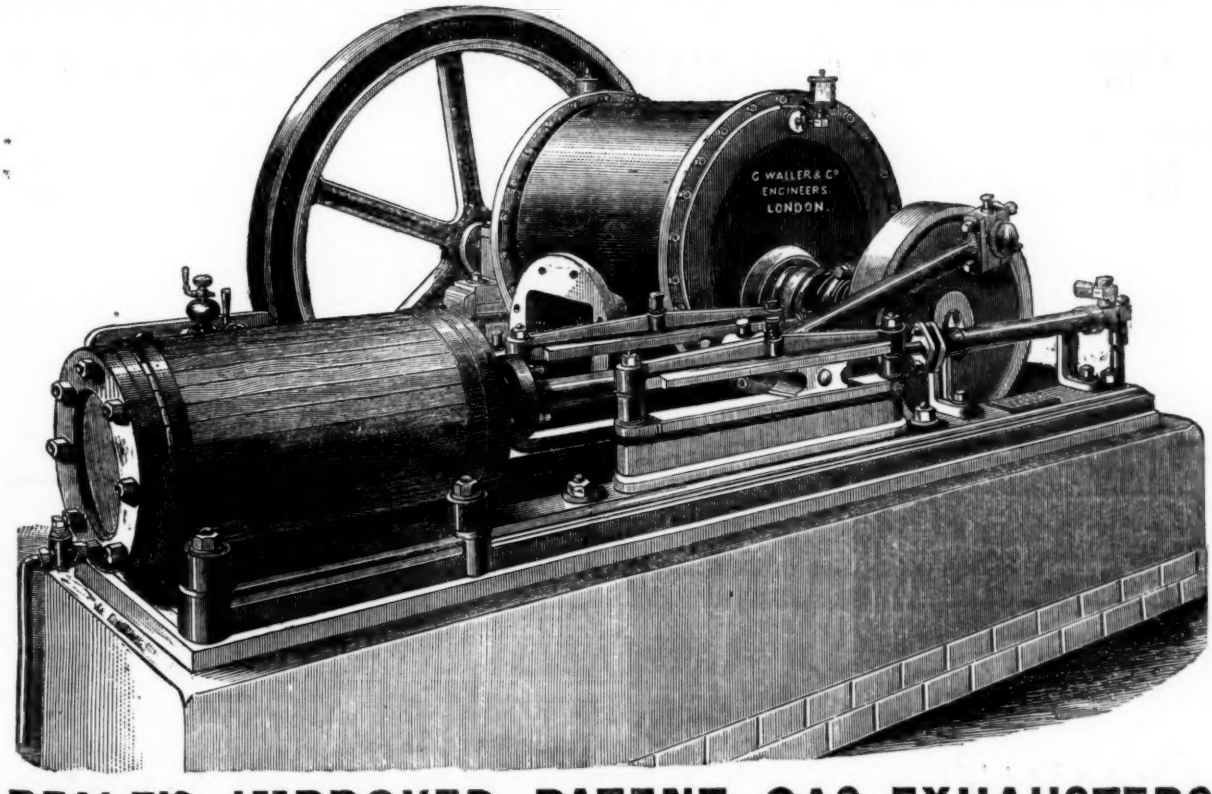
"I am able to report that the Meters have given in each test most satisfactory results."—*Mr. H. Sporne, City of London Meter Inspector.*
"I consider the arrangement is a great improvement upon the Meters in present general use."—*Mr. T. Jackson, Meter Inspector, Birmingham.*
"I would observe from the results of my testings that the Meters are a great improvement on the ordinary Wet Meters in general use."—*Mr. H. Airey, Meter Inspector to the Metropolitan Board of Works.*

COPIES OF REPORTS SENT ON APPLICATION.

MANUFACTURED BY

JOHN BENT & SON,
WET AND DRY GAS-METER AND GAS APPARATUS MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
Established 1830.

GEORGE WALLER & CO.,
GAS AND HYDRAULIC ENGINEERS.



BEALE'S IMPROVED PATENT GAS-EXHAUSTERS
AND
HORIZONTAL COMBINED ENGINES.

This arrangement, specially designed and manufactured **solely by G. W. & Co.,** is suitable for Works making 10,000 cubic feet and upwards of gas per hour. The **Exhausters** are of **full capacity** for the quantity of gas to pass, have **wrought-iron spindles** to ensure perfect safety in working, the flanges of cylinders and edges of covers are turned, inlet and outlet flanges turned, faced, and drilled, and the base of each Exhauster is planed. The **Engines** have wrought-iron connecting-rods, with solid gun-metal ends, steel piston and slide rods, turned and polished discs, heavy fly-wheels turned on rim and edge and polished, cylinders are lagged with polished mahogany and brass bands, and the bed-plates are planed on the bottom surface. A heavy bracket and plummer block, with strong gun-metal bearings, support the shaft between the Exhauster and fly-wheel.

Disc Gas-Valves, Self-Acting Bye-Pass Valves, Hydraulic Main Valves, Pumps, &c., always kept in Stock.

Phœnix Engineering Works, Holland Street, Southwark, S.E.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

(Successors to JOHN WILLIAM O'NEILL & CO.,)

Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,

CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.

WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

EDWARD COCKEY & SONS,

GAS ENGINEERS, FROME SELWOOD,

MANUFACTURERS OF ALL DESCRIPTIONS OF

APPARATUS CONNECTED WITH GAS-WORKS.

THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE

DRY-FACED VALVES

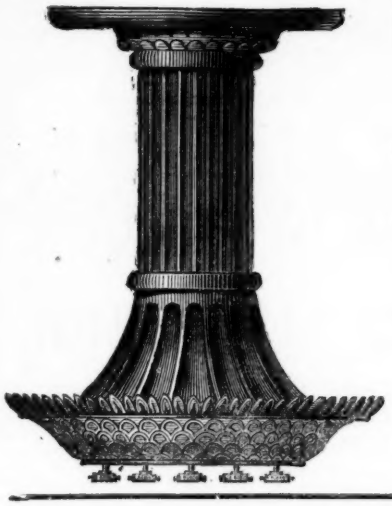
FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.



HENRY GREENE & SON,

GAS AND HOT WATER ENGINEERS,

155, CANNON STREET, E.C.

Manufactory: 19 & 20, NICHOLAS LANE, E.C.

SUN-BURNERS,

With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

For Churches and Domestic Use.

ARCHITECTS' OWN DESIGNS WORKED OUT.

ESTIMATES FREE OF CHARGE.

THE TRADE SUPPLIED.

SOLE CONSIGNEES FOR BRÖNNER'S IMPROVEMENTS IN GAS LIGHTING.

IN THE MATTER OF

BRÖNNER'S

GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Consignees for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, inform the public that, on the 20th of April, 1875, Julius Brönner obtained an injunction in Chancery against a defendant prohibiting him from advertising or selling as Brönner's Burners any Gas-Burner not manufactured by Julius Brönner.

Also, he obtained a similar injunction against another defendant on the 9th of November, 1875.

Also, he obtained a similar injunction against another defendant on the 13th of January, 1876.

Also, he obtained a similar injunction against another defendant on the 16th of March, 1876.

Also, he obtained a similar injunction against another defendant on the 6th of April, 1876.

HENRY GREENE AND SON invite the attention of the trade and public to the above proceedings, which they will continue to maintain against any person infringing Mr. Brönner's rights.

JOHN ABBOT & CO., LIMITED,

MANUFACTURERS OF

IMPROVED

HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS.

GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,

PARK WORKS, GATESHEAD.

LONDON OFFICES:
2, SUFFOLK LANE, CANNON STREET, E.C.

GLASGOW OFFICES:
54, ST. ENOCH'S SQUARE.

THOMAS ALLAN & SONS,

IRONFOUNDERS,

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 7 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

London Agent: Mr. A. C. FRASER, ST. STEPHEN'S CHAMBERS, TELEGRAPH STREET.

C. & W. WALKER,

8, FINSBURY CIRCUS,

LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

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BROAD STREET, BIRMINGHAM.

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WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

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CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

TO GAS COMPANIES AND THE TRADE.

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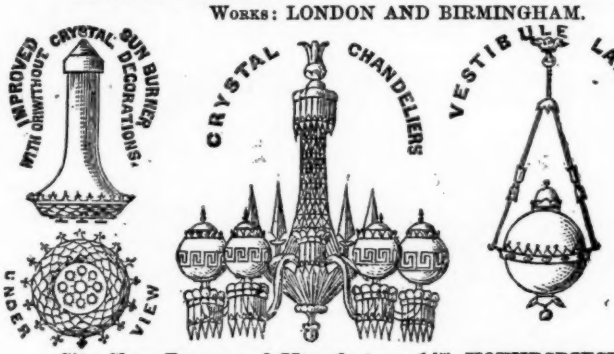

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ESTABLISHED 1830.

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SOLE AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

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Has on offer, in quantities to suit purchasers, Best Wigan Arley Mine, Orrell Screened and Unscreened Gas Coal and Nuts; Best Yorkshire, Real Old Silkstone, Derbyshire, and North Staffordshire Screened and Unscreened Gas Coal and Nuts; also Best Lancashire, Yorkshire, Derbyshire, and other Cannel, as supplied to some of the principal Gas Companies in England, to whom references are permitted.

Analysis and Prices forwarded on application to

HEAD OFFICES, STOURBRIDGE.

N.B.—Gas Managers will oblige by advising when they will be prepared to receive Tenders.

STOURBRIDGE FIRE-BRICKS, RETORTS, CLAY, &c.

ROBERT MARSHALL,

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SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

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GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields in *practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

MESSRS. WILSON CARTER & PEARSON, being contractors to several of the principal Gas Companies in the Midland Counties, have pleasure in being enabled to give them as references.

Chief Offices: Temple Buildings, 50, New Street, Birmingham.

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GRIRDROD'S PATENT

PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

LANCASHIRE.

ALBERT GAS COAL.

THE DERBYSHIRE

SILKSTONE COAL COMPANY,

LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered in trucks at any Railway Station in England, or shipped on board at Hull, Grimsby Docks, or Barrow-in-Furness.

Purified gas per ton of coal in cubic feet (average)	10,262
Illuminating power in candles	15·86
Weight of coke in lbs. per ton of coal	1,502

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

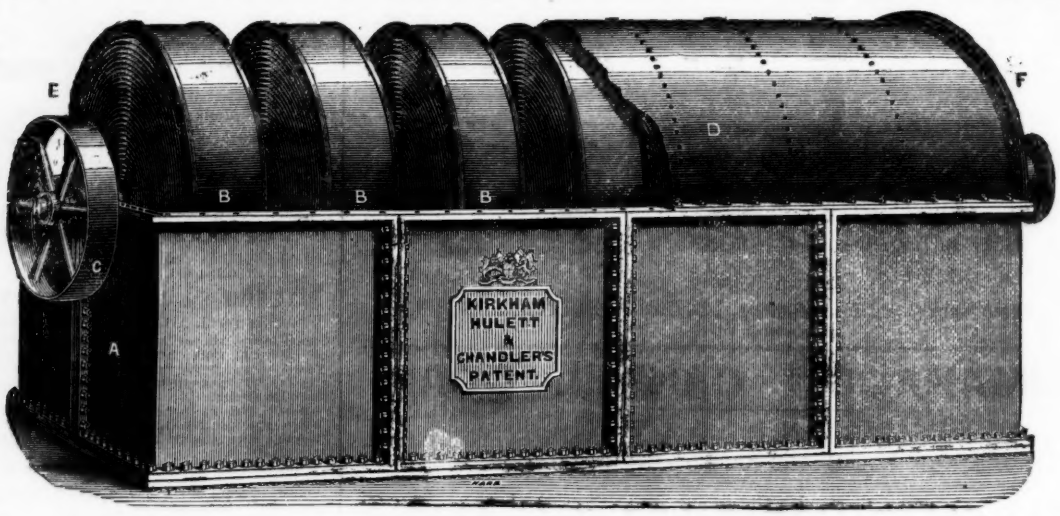
JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces 12,240 cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

STANDARD WASHER AND SCRUBBER.



The advantages of the Apparatus will doubtless be understood by those interested in gas manufacture.

The principal points of any Apparatus for the extraction of ammonia may be summarily stated as follows:—

1. **A large amount of Surface is desirable.**
2. **Such Surface should be always effectually Wetted.**
3. **The Surfaces or Scrubbing Material should cause no Pressure.**
4. **The Gas should meet various strength Liquors on its course.**
5. **However small the quantity of Water used, it ought to operate over the whole Surface.**
6. **Changing Scrubbing Material is both Objectionable and Expensive.**
7. **Economy both as to Space occupied and Cost of Apparatus is an important item.**

All these requisitions are supplied by the above Apparatus, of which the following is an explanation:—

A is a cast-iron tank, formed into several separate water-tight compartments.

B B B volutes of sheet iron fitted to the centre shaft, which is driven by the pulley, C, and causing the said volutes to revolve each in a separate compartment filled with water or other fluid.

D, the cover, has partitions fitted into it corresponding with those in the tank, sufficient space being left between the top of the partition in the tank and the lower edge of that in the cover, to allow the gas a free passage through the first volute to the second, and so on to the third, fourth, &c.

The action is as follows:—The crude gas entering at E is partly washed in the first compartment, which becomes 10 or 12 oz. liquor, or stronger if required, according to the quantity allowed to enter per ton; the gas then passes to the second, where the liquor is of a less strength; thence into a weaker liquor, as it passes from one compartment to the other, finishing at the last compartment or outlet, F, with clean water, which is constantly flowing and running over from one compartment to another, until it reaches the last space, from which it flows from the outlet-pipe into the well or tank ready for sale or removal.

Taps are inserted in each compartment for the convenience of drawing liquor for testing, &c.

Applications as to Cost, &c., may be obtained of either

Mr. D. HULETT, 55 & 56, HIGH HOLBORN;
Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER;
Or Messrs. CHANDLER, 104, NEWINGTON CAUSEWAY.

Inquirers will please state their Maximum Day Make.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

Messrs. NEWTON, CHAMBERS, AND CO.,

Gentlemen,

After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

The average of Nine samples gives a yield of 12,500 cubic feet of 15½ Candle Gas, being equivalent to 664 lbs. of sperm per ton, and 1420 lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

Yours truly,

JAMES PATERSON.

Full particulars will be sent on application to us—address as above.

CROLL'S
DRY GAS-METERS,

PRIZE MEDALS.

LONDON, 1851;
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(INVENTED & PATENTED IN 1844,)

COMBINING ALL THE LATEST IMPROVEMENTS,

MANUFACTURED ONLY BY

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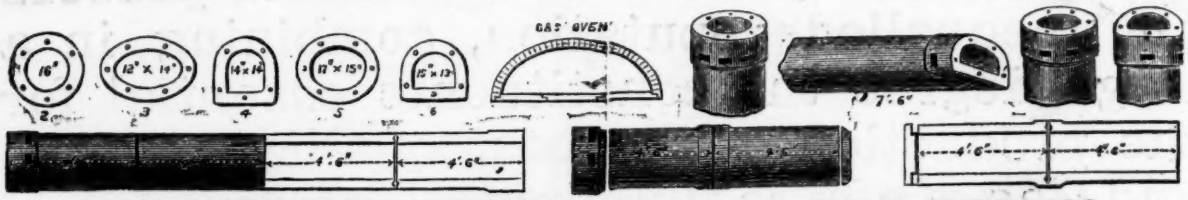

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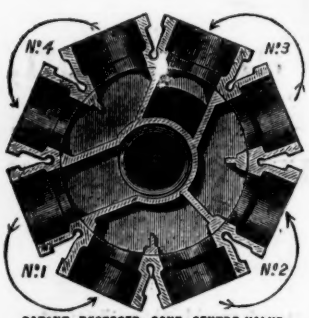

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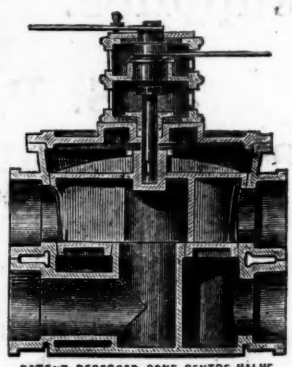

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Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
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By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

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For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

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Makers of all kinds of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

GAS HEATING AND COOKING STOVES.

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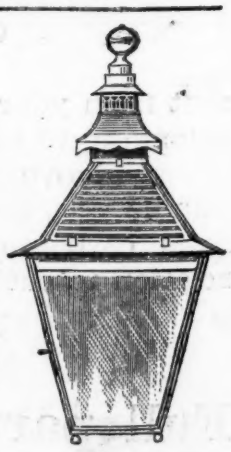

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